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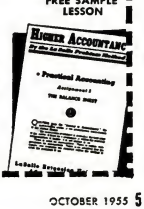

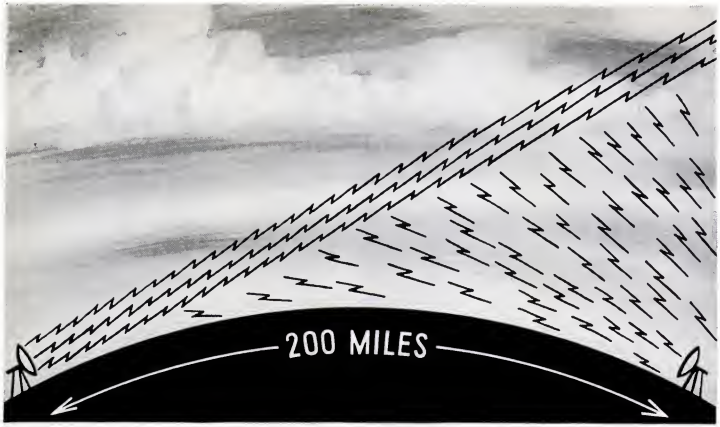

Highly schematic drawing shows possible distribution of energy in ultra-high-frequency "over-the-horizon" transmission. Effect is similar to that of a powerful searchlight whose beam points into the sky. Light can be seen miles away from behind a hill even when searchlight lens is invisible.

SOMETHING NEW ON THE TELEPHONE HORIZON

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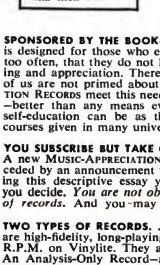

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Trans-Kleer storm windows require no nails, hooks, screws or tools. No back-breaking toil or broken glass to contend with. Cut off required amount, trim to fit the inside of your window large or small, square, round, rectangular—it makes no difference! Then press on the special Adheso border supplied and your storm window is firmly in place. Simple easy—a child can install them! And Trans-Kleer windows because of the LOW CONDUCTIVITY development of Reynolds engineers gives you real winter protection, actually keeps wintry blasts out of your home.

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At winter's end just fold away your Trans-Kleer like cloth for use next year. You can air the room at any time, too—lift the Adheso border to let in fresh air, then press back and it's sealed tight again! Clean easily with a damp rag. It's no wonder so many home owners, hospitals, churches and public buildings use them! TRANS-KLEER comes in kits 36 inches by 432 inches and costs you only $4.95 complete with Adheso border! That is enough for 10 windows—each measuring 10.8 sq. ft.—just 49½c each! In all you receive 108 SQUARE FEET for only $4.95! Good GLASS storm windows cost from $7.95 to $16.00—for ten you'd have to pay $79.00 to $160.00. With Trans-Kleer you not only save a terrific amount in the purchase price you also cut down enormously on your fuel bills!

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For years, demand for Trans-Kleer has outstripped the supply. Lucky buyers of the first windows told their neighbors and the word spread. Last year alone, over 2,000,000 were sold, yet thousands of folks were disappointed when the supply ran out. Advertising had to be curtailed and our huge supply was exhausted earlier than anticipated. There will be another wild scramble for them this year. Production has been planned for 2,500,000 this year—but even this huge total might not be enough unless you act FAST!

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WINDOW all winter!

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On a windy day, hold a lit match inside a closed window . . . the first gust of wind will blow it out. Now put up your Trans-Kleer window . . . a lit match will NOT blow out EVEN IF YOU KEEP YOUR REGULAR WINDOW OPEN!

ADVICE TO READERS

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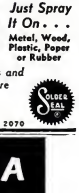

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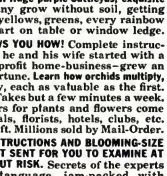

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Letters—

Fame Comes to MOUSE

The newspapers featured pictures from POPULAR SCIENCE MONTHLY in their stories about the satellite, or artificial moon, announced by the White House. How come?

JAMES G. KNOXLAND, New York City

This magazine furnished to the press the drawings that we published a year ago of the MOUSE (Minimal Orbital Unmanned Satellite of the Earth) proposed by Prof. S. Fred Singer of the University of Maryland—and closest in specifications, among detailed plans so far made public, to the kind of satellite now projected. It was described and pictured in POPULAR SCIENCE MONTHLY *for August, 1954.*

Readers interested in space travel might also like to refer back to these PSM articles: "How We Can Live on the Moon," July '55, pp. 57-59; "Moon's Mysteries Challenge Spacemen," Nov. '53, pp. 126-130; "How We'll Live on Mars," March '53, pp. 158-162; "What Will We Do With the Moon?" April '52, pp. 164-167; "How We'll Fly to Venus," Nov. '51, pp. 172-175; "Giant Doughnut Proposed as Space Station," Oct. '51, pp. 120-121.

Africa, Too, Likes Gus Wilson

Dear Mr. Wilson:

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C. KAROD,
Schagen, East Transvaal, South Africa

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When I have to go out suddenly and want to leave a house key for my young daughter, I tie the key to our dog Andy's collar and tie him in the yard. Then I stick

a note to the front door telling my daughter to get the key from Andy. No stranger is likely to figure out that Andy is a dog.

MRS. STANLEY CLARK, Bradenton, Fla.

Plywood Pool Holds Uncle Louie

Heard quite a few comments on the plywood swimming pool (PSM, June '55, p. 161). Several seemed to think she'd blow 'er seams when loaded with water. So I got my chief engineer, we dug out the handbook and our slip sticks, and after an hour or so of figuring and arguing we agreed that it probably wouldn't drop its load even if 240-lb. Uncle Louie hit the water from the high dive.

P. E. MCCAFFERTY, Stanwood, Iowa

Question: How Big Is a Bridge?

You claimed that the bridge to be built over the Narrows of New York Harbor will be the world's longest suspension bridge. Surely you have heard of the bridge now being erected over the Straits of Mackinac, connecting upper and lower Michigan. It will be much longer than the proposed Narrows bridge:

	Narrows Bridge	Straits Bridge
Length between anchorages	7,200 ft.	8,614 ft.
Length over-all	3 miles	5 miles
Center span	4,400 ft.	3,800 ft.

ED J. PHILLIPS, Ishpeming, Mich.

Suspension bridges are usually compared

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by the lengths of their center spans—the distance between the towers. When the Narrows bridge and the Straits bridge are both completed, this is how the center spans of the world's great suspension bridges will compare:

Narrows bridge.....4,400 ft.
Golden Gate (San Francisco).....4,200 ft.
Mackinac Straits.....3,800 ft.
George Washington (N.Y.).....3,500 ft.

The distance between anchorages *of the Straits bridge will be the longest of any suspension bridge in the world because its cables slope very gently. Several bridges are greater in* total length, *however, including the Chesapeake Bay bridge (7.73 miles) and the Oakland Bay (7 miles).*

Another Vote for Safer Cars

It's good news to hear that those Detroit brains have finally screwed up their courage to the point of admitting that cars sometimes have accidents [Aug., p. 88].

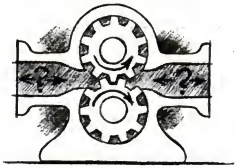
Besides safety belts, auto makers ought to do something about rigid instrument panels, spear-type hood ornaments, sluggish steering ratios and doors that can pop open like the lid on a jack-in-the-box.

DICK SULLIVAN, Boston

For a first look at all the safety features announced for the 1956 models, see p. 99.

Pump Problem

We want to rig a small gear pump for handling fuel oil on the farm, but my brother and I disagree 100 percent on the connections. Which is the intake and which



the discharge side when the gears are running as shown in the diagram?

J. H. MASTERSON, Red Bank, N.J.

Readers who feel they know how a gear pump works may want to mark the diagram before reading on:

The intake is at the right. Contrary to a common misconception, pumps of this kind do not draw fluid through the meshed teeth

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as clothes are pulled through a wringer. Fluid is carried around the outsides of both gears, between the tooth gaps and the close-fitting casings.

To Honk or Not to Honk

Recently I read in a newspaper that the French have a strict new law making it illegal to honk an automobile horn in Paris. And that instead of more people getting hit by cars, there actually has been a slight falling off of traffic accidents.

In some American cities, I understand, it is technically against the law to honk your horn except in an emergency as a real warning against imminent danger. But nobody, including the cops, pays much attention to those laws.

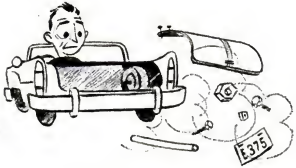
So let's go the French one better and just make cars without horns. It would not only save our ears and our nerves but probably some lives, too, by tending to make people drive more carefully.

EDGAR WINSTEAD, Kansas City

How do other PSM readers feel about this? We'll be happy to print the best letters received on either side of the argument.

Watch Out for Fast-Buck Boys

With news about new cars becoming an important part of PSM's coverage, why is there never any mention of the increase in shoddy workmanship, sloppy assembly



methods, inadequate assembly inspection?

Car dealers are loaded with so many new cars that in many cases short cuts are taken in preparing a new car for delivery. Result is a source of aggravation to the owner who has just laid out a considerable bundle. Many dealers are just out for the fast buck.

R. BLAGDEN, East Hampton, Conn.

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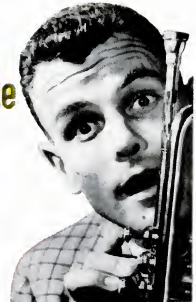

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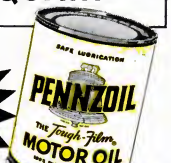

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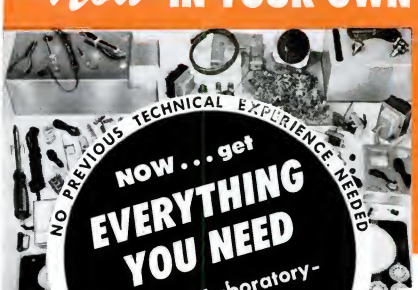

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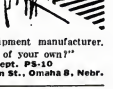

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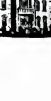

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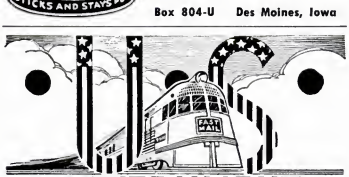

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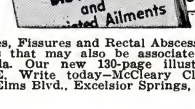

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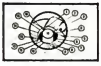
Note electrodes closely. A circular arcing area (four concave segments). Gap being the same from all points. Electricity has property of arcing from coldest point. Current also arcs more readily from apex of two planes than from face of a flat, metallic surface. Note that there are 16 apexes (where two planes meet) — all the same distance from the center electrode.



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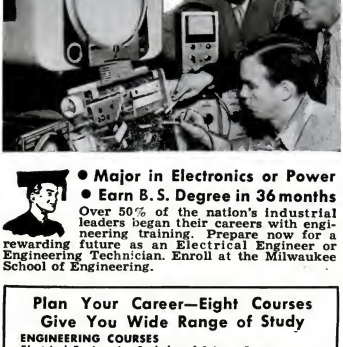

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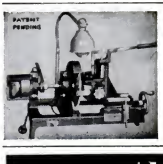

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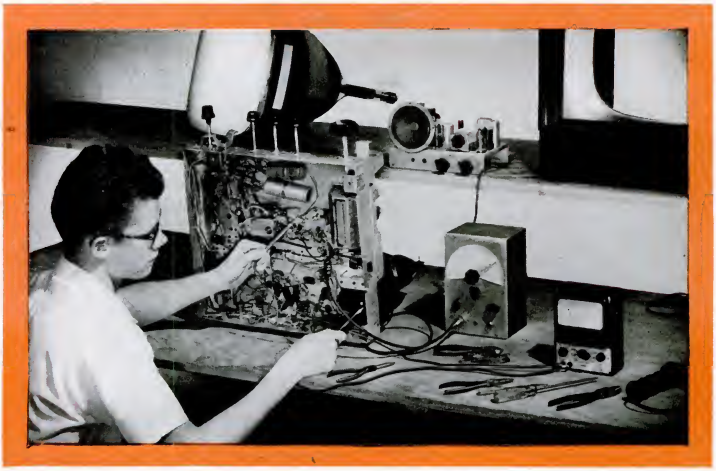

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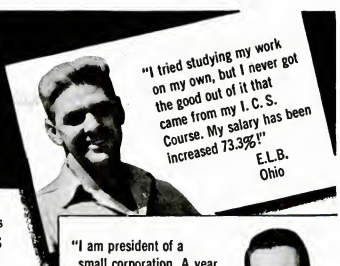

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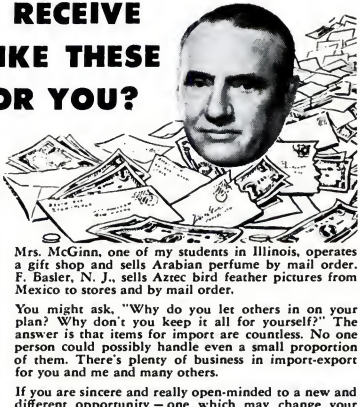

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To most people, importing smacks of mystery, romance — and "costly" things for collectors. Actually, any capable and ambitious man or woman should learn import-export quickly. And, there are thousands of beautifully made imports obtainable at trifling cost abroad to sell in the U.S. by mail order. There are also great opportunities in exporting U.S. products.

Native villages in Africa, romantic Vienna, bustling Copenhagen, mysterious Hong Kong — yes, countryside hamlets and great cities all over the world produce fascinating products.

Using my plan, you don't have to travel abroad unless you want to. You don't even have to know a foreign language. And, there is no face-to-face selling in mail order.

I have proven this plan with 103 imports — and the opportunities for the sale by mail of thousands more are breathtaking in their possibilities. Hunting knives and binoculars from Germany, silverware from Sheffield, England — hand-carved art objects from Africa — all costing less than $1 abroad have values up to $5 or more here and are big sellers by mail order.

Monthly bulletins sent free to those who follow my plan show suppliers of new and desirable imports.

As I write this, I am receiving as many as 1,000 cash orders a day for imported clocks — all by mail order. They cost me only 63¢ and I sell them far below the U.S. market — a terrific bargain and a wonderful seller. And, I don't stock them as they are shipped direct to the buyers from abroad, *after I receive the cash.*

So you see, it is even possible to conduct a business of this kind without investing in merchandise.

Mrs. McGinn, one of my students in Illinois, operates a gift shop and sells Arabian perfume by mail order. F. Basler, N. J., sells Aztec bird feather pictures from Mexico to stores and by mail order.

You might ask, "Why do you let others in on your plan? Why don't you keep it all for yourself?" The answer is that items for import are countless. No one person could possibly handle even a small proportion of them. There's plenty of business in import-export for you and me and many others.

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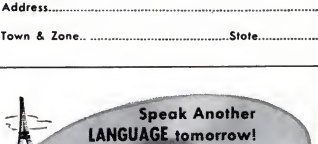

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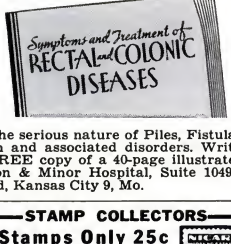

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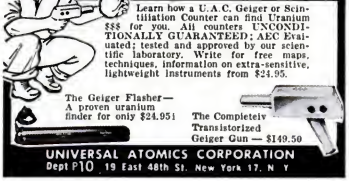

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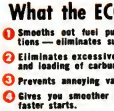

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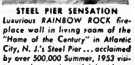

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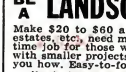

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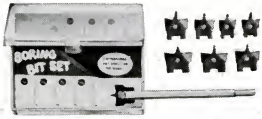

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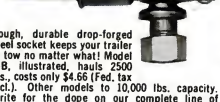

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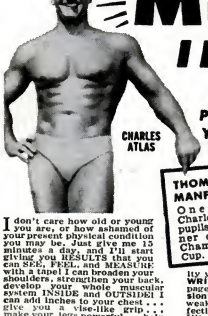

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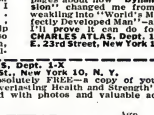

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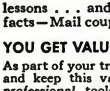

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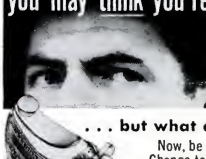

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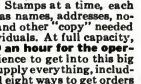

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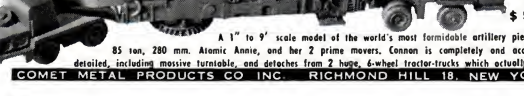

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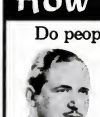

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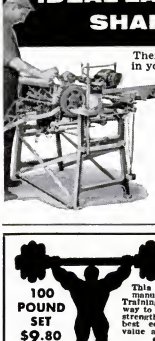

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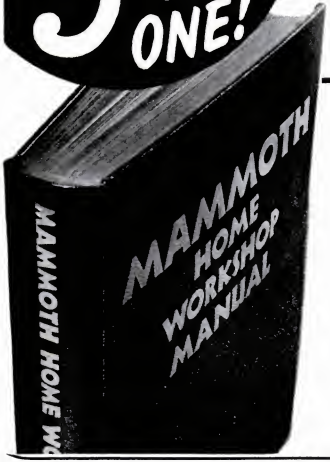

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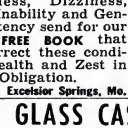

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"MAKE Perfumes", other products—Sell mailorder—Catalog Free. International, 6347 Parnell-PS-10, Chicago 21, Illinois.

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NEW idea chemical and apparatus outfits for home experimenting. Photo-scales, microscopes, chemicals, biologicals, and laboratory supplies in small quantities. Catalog 25c. Established 1931. John H. Winn, 124B West 23rd St., New York, N.Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 20c. Tracey Laboratories, Evanston, Illinois.

ROCKETS: Solid Fueled. Theory, Construction, Fuels, $2. Aerouniv, 530 W. Wyoming, Philadelphia, Penna.

CHEMISTRY, Biology, Catalog 25c. Laboratory Sales, Box 161-B, Brighton, Massachusetts.

AMAZING New Book of Science, Experiments, Formulas and catalogue of Laboratory Supplies. Only 25c. National Scientific Co., Dept. PS-10, 2204 W. North Ave., Chicago 47, Illinois.

CHEMICALS and apparatus for industrial, analytical and private laboratories. Catalog 25c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N.Y.

5 BOOKLETS, 299 Pages: "Beginners Chemistry" "Chemistry Familiar Things" "Physics" "Electron Theory" "Atomic Theory". All five .50c. Franks, 3121 South Racine, Chicago 8.

EXPERIMENTERS: Bargain Supplies Catalog—20c. Hagenow Laboratories, 2414 Clarks, Manitowoc, Wisconsin.

MAKE Extra Money. Sell front door name plates to friends, neighbors. Retail $1.98—you make $1.00! Free selling kit. Modern Engraving Co., P.O. Box 194, Boston 14, Mass.

42 HELP WANTED

OVERSEAS, Latin American, Alaska, Canada Employment. Originator 1955 "Foreign Service Directory" Up-To-Minute Report on Military & Civilian Construction; Oil Companies; Aviation; Transportation; Steamship; Mining; Government Job Info. How-When-Where to apply. Listing Firms Hiring. $1.00. Global Reports, Box 883-S, Hollywood 28, Calif.

MIAMI, Jacksonville, Or Atlanta Business and Employment Opportunities Newspaper Section Airmailed $1.00 Each. Or three for $2.25. Letter remailed 25c. B. Duca, 1260 120th St., Yukon, Florida.

EARN to $1500 Monthly. Many Jobs Available. Work in Fabulous South America. The Islands, Africa, USA, etc. All Trades. Labor, Clerical, Truck Drivers, Mechanics, Engineers, etc. Tax Free Earnings. Chance to Travel. Fare paid if hired. Make and Save a fortune. Application Forms. Free Information. Write Dept. 76D, National Employment Information, 1020 Broad, Newark, New Jersey.

MIAMI and Jacksonville Help Wanted ads airmailed, $1.00. Hayward Parker, 3223 Dignan St., Dept. PS, Jacksonville, Florida.

OPPORTUNITIES Unlimited—New York City help wanted columns, Sunday editions air mailed—State male or female—$1.00. Talbot, Bernardsville, New Jersey.

PHILADELPHIA — Complete Classified Sections from two metropolitan papers Airmailed immediately. $1.00. Barnes, Box 124, Wynnewood, Penna.

"FOREIGN, Alaskan, U.S.A. Jobs!!" Latest Copyrighted Reports! Who to contact for highest paying jobs. To $1500.00 Monthly. Laborers, Trades, Truck Drivers, Equipment Operators, Helpers, Apprentices, Clerical, Engineers, Others. Over 52 Countries—St. Lawrence Project, Spain, Latin America, Europe, Asia. Year Registration-Advisory Service. Application forms, Unconditional Money-Back Guarantee of Satisfaction! $2.00. Airmailed $2.25. (COD's Accepted). International Reporter, Box 1047-SW, St. Louis 1, Missouri.

NEW York help wanted columns airmailed $1.00. Model resume included. Box 203, Montrose, N.Y.

MIAMI jobs. Complete classified Section Airmailed $1.00. Letters remailed Miami $.25, Postcards $.10. Grace Gainer, Box #726, No. Miami, Florida.

CONFIDENTIAL reports on best paying jobs with travel, adventure and top pay. Construction, aviation, shipping, laborers, clerical, trades, unusual opportunities, all types of work. Foreign and U.S. Only $2.00, including year advisory service. ($2.25 Airmail). Guaranteed best service of this type available or double your money back. Research Services, Box 2904-PSA, St. Louis 17, Missouri.

START mail order business in your own home. We supply catalogues, circulars etc., ship orders under your name (no stock to carry) and show you exactly what to do. Postcard brings complete details, instructions absolutely free. Topval Corp., Lindenhurst 226, New York.

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43 AGENTS WANTED

YOUR own business—Suits $1.50; Overcoats 65c; Mackinaws 35c; Shoes 12½c; Ladies' Coats 30c; Dresses 15c. Enormous profits. Catalog Free. Nathan Portnoy Associates, 1218-J South Jefferson, Chicago 7.

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GOLD or Silver letters, numbers. Windows, Doors, Trucks. 1" to 6". 500% Profits—Free Samples. Atlas-U, 544 West 79th, Chicago 20.

ABSOLUTELY Free—Sales Kit. Increase your income. Send postcard today requesting kit showing new line, belt buckles with your name or personal initials, cap badges, tie clasps, choice 3000 different emblems. Hook-Fast, Box 1425PS, Providence, R.I.

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SELL amazing value 21 for $1.00 Christmas, All Occasion greeting card assortments. Newest Tall cards, unusual wrappings, novelties. Profits to 100% plus bonus. Write for Feature boxes on approval, 77 free samples Personal Christmas Cards, Stationery, free Catalog, Selling Guide. New England Art Publishers, North Abington 1033-H, Mass.

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MEN! Make $1000 a month with 3-second demonstration of powerful, Midget Presto Fire Extinguisher to homes, offices, factories, car owners, garages, farms, etc. New chemical beats expensive extinguishers. Only $3.98 with big profit. Merlite, 114 E. 32nd, Dept. 50-A, New York 16.

EASY handwork makes fast-selling articles. Sample free. Sunmade Company, Brockton 64, Massachusetts.

BEAUTIFUL, Feather Pictures from Mexico. Send 25c for Sample and Price list. The Tradewinds Company, Box 254, Wilder, Vermont.

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DAY-Glo Letters, Samples. Edward Cook, 51 Martin Avenue, Saratoga Springs, New York.

EARN $30 A Day! Sell Dab-It, amazing pocket-size, stick-form, "no ring" spot remover. Works like magic! Guaranteed! M & M, S-3, 842 Third Avenue, New York 22.

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BIG Money in plate or pipe welding. G.I. Approved. Free Catalog. Tulsa Welding School, 919B E. Second, Tulsa, Oklahoma.

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DETECTIVE Training. Phillips Secret Service System, 1917-C North Kenneth, Chicago 39 Ill.

DETECTIVES. Work Home—Travel. Free particulars and badge. Exchange Secret Service System, 4554 Broadway, Chicago 40.

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RUBBER Stamps. Complete Line. Catalog Free. Weymouth Rubber Stamp Company, North Weymouth 91, Massachusetts.

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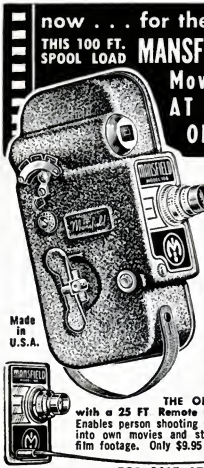

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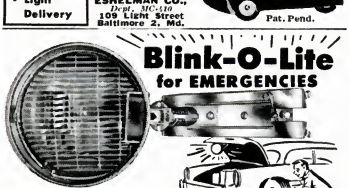

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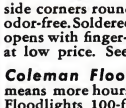

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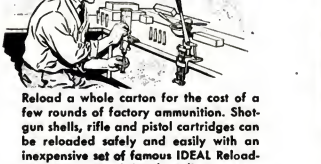

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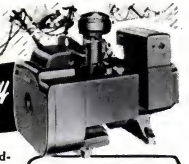

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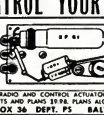

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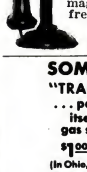

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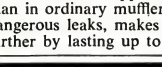

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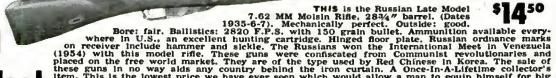

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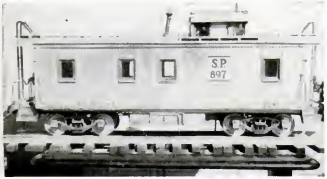
Builds Live Steamer. This model, operating at 100-lb. steam pressure, took Jack Fesco, a Los Angeles engineer, about 3,000 hours to build. It is 75 inches long and 12¾ inches high, scaled ¾ inches to one foot.

Like the original Mountain-type engine, the model has power-reverse gear, working dynamo, feedwater pump, front-end throttle and mechanical lubricator. The caboose (below), on the same scale, took four years of spare time to make. It has operating hand brakes and automatic couplers.



Model Locomotive Hauls Passenger. William Harmeling, Chicago barber, built this 1½-inch-to-one-foot locomotive for his grandson. With tender, it is five feet long and is powered by a ⅓-hp. electric motor. It runs over 150 feet of track, measuring 6½ inches between rails. A protected third rail transmits the electricity.

"Diesel" Scaled to Kid Size. Youngsters in Fred Gehrer's neighborhood in San Antonio get a kick riding on 60 feet of track in his miniature train. Gehrer started with a second-hand refrigerator motor and used salvage parts. The total cost was $60.

Spark plug engineering takes another great stride forward

with CONDUCTASEAL

AC engineers fuse metal and ceramics to form the world's first current-conducting spark plug seal!

For years spark plug engineers have tried to solve the problem of seals that eventually break down and permit gas leakage between the center electrode and spark plug insulator.

Loss of compression is bad enough, but the results are even more far-reaching because plug heat range is seriously affected. Plug insulators and electrodes get hotter than they should . . . plug tips operate at temperatures far different from that for which they were designed . . . and car performance suffers.

But, AC engineers have found the answer!

AC's patented and exclusive *Conductaseal* feature guarantees uniform spark plug heat range and holds heat right *where* it should be . . . in the famous recessed Hot Tip, where it burns away carbon and oil deposits as soon as they form. This keeps plugs clean longer . . . boosts power . . . saves as much as one gallon out of every ten.

Why not have a set of lively Hot Tip AC's installed in your car? Get a new set every 10,000 miles.

Holds heat right where you want it—in the famous AC HOT TIP!

AC SPARK PLUGS

GM GENERAL MOTORS

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION • FLINT, MICHIGAN

POPULAR SCIENCE MONTHLY'S . . . Last-minute news & notes

OUR STOCK OF A-BOMB MATERIALS MUST BE AMPLE, since the Government is discouraging "dual-purpose" atomic-power plants--those designed to produce plutonium (for A-weapons) in addition to electricity. Plutonium price has been set so low that it won't pay power producers to bother with atomic fuel...THE POWER OF THE H-BOMB ALSO WILL BE HARNESSED FOR PEACEFUL USE BY 1975, predicts Dr. Homi Bhabha, Indian physicist. Controlled atomic fusion rather than fission (the A-bomb method) will make it possible.

YOU MAY BUY TOMATO JUICE BY THE BAG SOON. A high-quality tomato powder has been developed by the U.S. Agriculture Department working with the Chain Belt Co. of Milwaukee...PEOPLE IN GLASS HOUSES WILL BE ABLE TO THROW STONES, says the Pittsburgh Plate Glass Co., which has developed a construction glass that it claims to be both strong and shock resistant...MUSICIANS ALL OVER THE WORLD CAN NOW PLAY IN PERFECT HARMONY. Meeting in Stockholm, Sweden, delegates from 37 nations agreed to raise the pitch of the basic tuning note "A" from 435 to 440 oscillations.

CARS WILL BE FINNIER IN '56. Pictured at left is the tail--all the manufacturer will release--of the '56 model of one of the better-known low-price cars. (The new Lincolns, Mercuries and Fords are described in this issue on pages 102, 106 and 108; General Motors, Chrysler and the independents will be covered in upcoming issues.)...WILL INSTALLING SEAT BELTS IN YOUR CAR CUT YOUR INSURANCE COSTS? Yes, say two Southern companies. They offer rate cuts of about $5 to policy holders who install the safety device...THE RUST IN THE CREVICES OF YOUR CAR IS DIFFERENT FROM THE RUST ON ITS SURFACE, report GM researchers. The first type is porous, causes further rusting. Surface rust, however, actually resists further rusting...PLASTIC MATERIALS COULD REDUCE POTENTIAL AUTO DAMAGE, claims Cornell Aeronautical Laboratory. In one test at five m.p.h., a plastic fender was merely scuffed, a steel fender sustained an estimated $20 damage.

Mystery Fin

DO CATTLE SLEEP? Rarely, if ever, under normal conditions, says British scientist C. C. Balch. They have to stay up, he suggests, to redigest their food.

What a whale of a difference

Natural Viscosity makes !

As delivered to the consumer, New Gulfpride H.D. Select SAE 30 and a typical 10W/30 multi-viscosity oil are about equal in viscosity or "body."

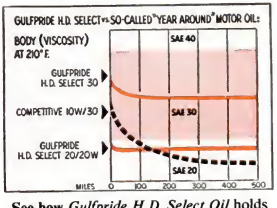
But see what happens after 300 miles of use in an engine. The multi-viscosity oil, in the viscosimeter at left, runs out much faster than before. The reason is that the thickeners, used to bolster the viscosity of multi-vis oils, *start to break down* within as few as 25 miles. The oil loses efficiency—while oil consumption increases.

Gulfpride H.D. Select, on the other hand, has *natural* viscosity—contains no thickeners that break down in service. And so, as the viscosity test shows, Gulfpride H.D. Select flows at the same rate as before, stays tough and full-bodied . . . assures lower oil consumption.

That's just one of the benefits you get from new Gulfpride H.D. Select Motor Oil. In addition, new Gulfpride H.D. Select . . .

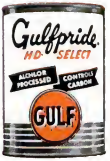
- **Controls carbon**
- **Combats corrosive acids, rust and deposits**
- **Provides the toughest protective film ever developed in a motor oil.**

New Gulfpride H.D. Select is available in 3 grades —SAE 10W, SAE 20/20W, SAE 30. Lets you follow the manufacturer's recommendations *for your car during each season.*



See how *Gulfpride H.D. Select Oil* holds its viscosity in service as compared with a typical "all-season" multi-viscosity oil.

New Gulfpride H.D. Select



The only motor oil in the world super-refined by the Alchlor Process for modern high-compression engines.

Presenting

AMERICA'S MOST BEAUTIFUL OUTBOARD MOTORS

NEW! THE JOHNSON *Javelin*®

30 HP . ELECTRIC STARTING

CONCEALED CONTROLS

Johnson Sea-Horses have a *new* sparkle—the flash of gorgeous styling in Holiday Bronze and Spray White! They're *smart*. They *gleam*. You'll recognize them at once as something new and beautiful in outboard motoring.

NOW 9 MODELS 3 TO 30 HP!

For 1956 there are *nine* Johnsons—a complete range of sizes—from the lightweight "3" to the spectacular new "30." Never before has Johnson offered such on-the-nose power selectivity!

Most breath-taking of all is the new Javelin, Johnson's custom model for distinctive outboard craft. Electric starting. Concealed controls. Holiday Bronze and Spray White, with bright wrap-around cowling of polished stainless steel. Owner's initials available. Here is *fashion* in outboard boating—HIGH fashion and no mistake!

See the new models at your Johnson Dealer's. Look for his name under "Outboard Motors" in your classified telephone directory.

Free! Write for your copy of the *new* Sea-Horse Booklet, describing all models.

JOHNSON MOTORS
500 Pershing Road, Waukegan, Illinois
A DIVISION OF OUTBOARD, MARINE & MANUFACTURING COMPANY
In Canada: Mfd. by Johnson Motors, Peterborough

Johnson
SEA-HORSES FOR DEPENDABILITY

FOR 1956

*JAVELIN	30 hp	$580.00
*SEA-HORSE 30	30 hp	550.00
SEA-HORSE 30	30 hp	460.00
*SEA-HORSE 15	15 hp	450.00
SEA-HORSE 15	15 hp	360.00
SEA-HORSE 10	10 hp	320.00
SEA-HORSE 7½	7½ hp	240.00
SEA-HORSE 5½	5½ hp	215.00
SEA-HORSE 3	3 hp	145.00

**Electric Starting. Prices f.o.b. factory, subject to change. OBC certified brake hp at 4000 rpm (30's at 4500 rpm).*

The New Cars Will Be Safer

Serious injuries such as this woman received will be averted by the changes being made in factories now

SAFETY WHEEL Though the column is shorter, the conically angled spokes—designed to absorb impact—hold the wheel rim in its normal position. The safety features pictured here appear on 1956 Ford company cars described on pages 102-110.

PADDED VISORS Here the purpose is to add protection in the considerable number of cases where the head strikes high. On closed cars, the windshield header can be padded.

SAFETY DOOR LOCK One type, being adopted by Studebaker, keeps car doors closed despite distortion of body in crash (below) against barrier at 40 m.p.h. In Ford's new design, at right, a steel plate (arrow) slides behind teeth of rotary latch to keep it from being pulled away from fixed rack on center post. Sharp blows won't jerk them apart unless force is severe enough to rip out star wheel or break teeth.

Safety Features Show

AT IMPACTS over 40 m.p.h., by far the best safety device is to have a capable and hard-working guardian angel. Nothing else counts as much.

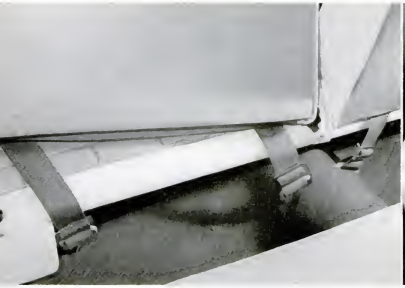
But below this speed, the characteristics of a car may mark the difference between fatal injury and merely crumpled sheet metal. The point is not academic: National Safety Council figures indicate that 47 percent of all fatal auto accidents in 1954 occurred at 40 m.p.h. or under. Even on the high-speed Pennsylvania Turnpike, about half the deaths have resulted from impacts at 40 or below.

The problem of survival. A speed of 40 m.p.h. seems tame to most drivers—a kid can bicycle downhill at this rate, and a good horse can touch it for a short stretch. But if you slam an automobile into something solid at even slower

SAFETY MIRROR A special adhesive coating is used on the back of the glass. This will not keep it from shattering under impact, but it will stop most glass fragments from flying.

PADDED PANEL The top and edge of the dash can be covered with energy-absorbing material. It isn't as soft as it looks; this was a hard jab. The surface doesn't stay indented, but recovery is slow, as safety experts say it should be.

SAFETY BELTS By letting people "wear" the car in a crash, belts are probably the most important single safety feature. They keep the body from pile-driving behind head impact. Strong anchorage to floor pan and frame is used. The buckle shown has a double-hinged grip for easy release. To keep them from adding to crash inertia, both the front and rear seats are more firmly anchored. Like padding, belts are options.



Up in First '56 Cars

speeds—say 30 m.p.h. at impact—some pretty grim things can result.

According to the crash tests that Ford has been running (see Aug. PSM, p. 89), the driver is liable to smash in his chest on the steering column. The right-seat passenger is liable to crack his skull on the windshield header or instrument panel, or both—in lightning-fast sequence. The front seat is liable to rip forward off its adjustment track. Passengers in back and perhaps the rear seat itself are liable to come hurtling forward.

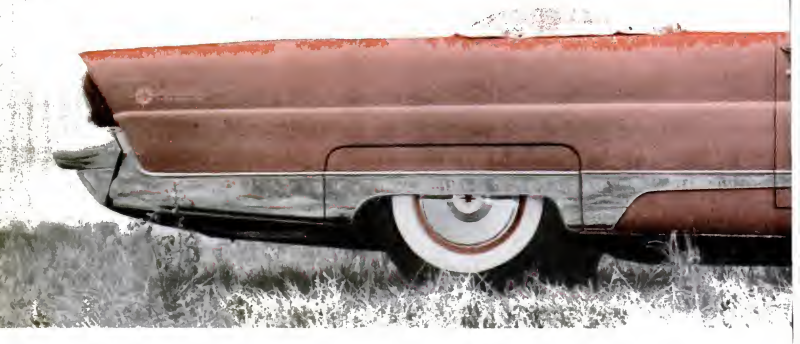
There is also the perilous probability that the doors will fly open, spilling out people and greatly increasing the chance of severe injury. (The greatest risk of death in a collision comes after ejection.)

As a major step in attacking the prob-

[Continued on page 250]

FIRST OF THE '56 CARS

New Lincoln:



Taking out after Caddy with a snarl to its twin pipes, Lincoln has a larger body and more engine. Yet it still handles well.

By FRANK ROWSOME JR.

THE new Lincoln is plainly intended to jar Cadillac loose from its lordly eminence. Even though unseating the fishtailed champ won't be easy, the 1956 Lincoln is as promising a white hope as you are likely to see this year. Highlights:

- More length and width, to take the car out of its runty ranking in the high-priced class.
- A new chassis, to slice height and make better use of the new dimensions.
- New styling, which edges as far away as the designers dare from chrome scars and the clang of cymbals.
- A muscular 285-hp. engine, to whip up acceleration and top speed above their recently sleepy levels.

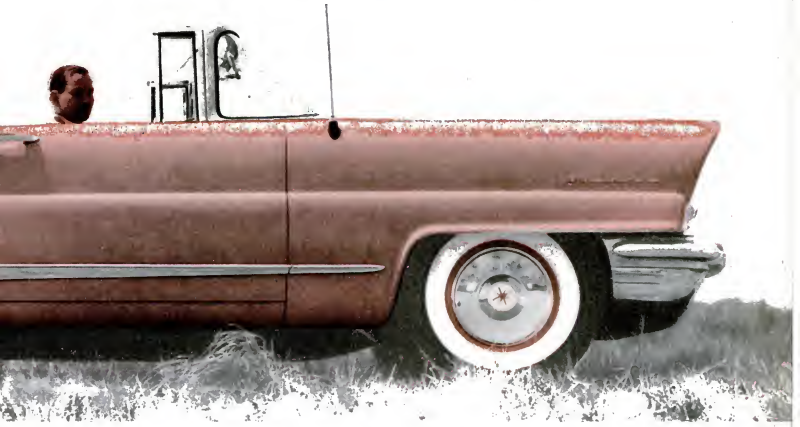
Drag race between '55 and '56 sedans puts new one (nearer)

1

2

3

Bigger and Brisker



• Continued catfootedness, despite handicaps of greater size and weight.

Besides these major changes, there are also two new crash-safety features, a new power-steering unit, and a tricky new carburetor air intake that's likely to prod the imagination of do-it-yourself guys owning other makes of cars.

Big girl now. To pick up some walking-around money, high-tail it to the nearest sporting establishment and work up some bets on comparative sizes of 1955 big cars. Chances are you'll find some character who doesn't realize just how small Lincoln has been. Its 1955 over-all length (215.6 inches) was shorter than that of Cadillac, Packard or Chrysler (including the Windsor); it was even shorter than a Buick Super or a DeSoto. In the wheelbase department, Lincoln has been still runtier; in 1955 one Pontiac model had a longer wheelbase than Lincoln's 123 inches.

This comparative compactness may have helped roadability (though Lincoln engineers dispute it), but it also made the '55 cars a trifle cramped by carriage-trade standards. Rear-seat passengers in '55 hardtops or convertibles have about as much leg room as in a well-tailored sleeping bag. This has hurt, by reason of the curious national trend to buy cars

out in front by almost a length and a half in four seconds.

4

5

6

Both front and rear styling use same horizontal-louver theme. The brightwork is not excessive.

NEW BACK BUMPER has twin pipes moved up to act also as anti-hook guards. Gas filler is behind license.

HEAVILY HOODED headlights look as if they might pack with wet snow. This is a problem with many newer cars.

like yard goods, on the assumption that the longer a car is, the more you get for your money. Few people enjoy socking out $4,000 for a vehicle in which the preferred rear-seat passengers are dwarfs.

Lincoln has no such problem for 1956. Wheelbase is up three inches to 126; over-all length is up 7.26 inches to 222.9; and maximum width is up 2.28 inches to 79.9. The car is also 2.46 inches lower, though ground clearance (6.73 inches) has only been pared a fraction of an inch—a comfort when you drive your Capri off the highway in pursuit of coyotes.

The net effect of these changes is interesting. The big increase is over-all length, not wheelbase—which is *still* three inches shorter than the shortest '55 Caddy's—and it appears to have been spent mainly in the passenger compartment. It's no longer necessary to be stunted to fit in back; the extra inches have *not* gone into hanging gardens of zinc up front or into a protruding rump.

On the turns. As for the effect on handling, hasty judgments that "they've thrown away Lincoln's roadability to lure more customers"—which was this writer's early impression—are likely to be dead wrong. If you drive, as PSM's reporter did, both the '55 and '56 in frequent alternation on the Ford test track's curvy "handling roads," you'll conclude that the handling, though different, is still very good indeed.

In a tight turn the new car is flat and precise. It rarely makes you feel nervous, and it doesn't slip into the wallowy, into-the-pasture antics of many U. S. sedans if you change direction sharply. The rear end does seem to break loose a trifle sooner (the '56 is about 250 pounds heavier, almost all in back), but the difference, if any, is very slight. Lincoln in 1956 is still a driver's car.

Power steering is no longer optional. Standard equipment includes a brand-new Saginaw hydraulic booster—developed jointly by Saginaw and Lincoln—that uses an in-line power action. As valved for Lincoln, the response "threshold" is set low enough to be inconspicuous. Pared down to 20.9:1, the over-all steering ratio is a bit faster than last year's.

More engine. Despite the Mexican-race record, Lincoln has not been among the most rapid U. S. cars. Caddies and Chryslers have consistently bettered its 110-111 m.p.h. top. Acceleration, too, has not been exactly breakneck. In 1955 there have been a number of cars (including, embarrassingly, Chevrolet) that could generally whip Lincoln in green-light brushes. Even kid-brother Mercury did at least as well and usually better.

The new car won't be taken as easily. Displacement has gone up 27 cubic inches to a big fat 368—a great, disgusting 6.03 liters, if you're among the beret set—and horsepower is rated at 285.

Torque has been kicked up to 401 foot-pounds, 67 more than last year. Shift points at full throttle on the automatic transmission have been nudged upward to match the new curves. The car scoots up to 60 (true, not indicated) in 11.3 to 11.5 seconds, which is amply fast for any well-adjusted driver. And, while it is perhaps not enough to stay ahead of that power-pack Chevvy up to about 55, a combative Lincoln owner can then snow the upstart under with horsepower. As for top speed, the new 120- or 121-m.p.h. peak is brisk enough for all conceivable needs.

Both bore and stroke contribute to the increased displacement; bore goes from 3.94 to an even four inches, and stroke from 3.5 to 3.66 inches. The compression ratio moves up from 8.5 to 9.1. The engine has been worked over in many details—there's a new distributor with two control diaphragms, a new four-barrel carburetor, a new 12-volt ignition system, and a tricky new crankcase ventilation system, complete to a little cyclone separator on the oil filler pipe.

Two noses. By far the slickest new gadget under the hood is a dual intake for carburetor air. With minor exceptions, U. S. cars have hitherto been content to snuff in the air above the engine, much of which has come in through the radiator. This is convenient but not particularly efficient. In the summer, with the engine running warm, underhood temperatures are so high that the air simply isn't dense enough—it doesn't have as much oxygen per unit of volume—for the engine to give full power.

If cooler outside air is sucked in, things are fine *until* temperatures drop below the high sixties. Then the other horn of the dilemma pricks: below 65 degrees, particularly when the humidity is high, the moisture-laden air may ice up as it races past the pressure drop in the carburetor throats. Modern engines and fuels are often prone to this icing, which causes stalling, bucking and rough running during warm-up.

Lincoln's treatment is to put a snout

[Continued on page 260]

PEDAL STRADDLES steering column, well braced against any sideways thrust from either foot in braking. This is a power-braked car—to be a high percentage of '56 production—and the pedal has moderately reduced travel. You can still stop the car smartly, engine killed and vacuum reserve used up, if you push harder. Note that the accelerator has suspended linkage, eliminating a hole in the toe board.

THE BEST AIR for good engine performance is fed by ductwork shown above. The flap valve above the disconnected tubing is worked by a thermostat. Below 68° it draws some air from a "stove" around the exhaust manifold, preventing carburetor icing. But if air under the hood is too hot, the valve feeds the engine outside air from ahead of the radiator. Cool air, being denser, gives more power.

New Mercury: More

You can't see much difference, but you can feel it. Wow-ie acceleration plus fine road sense and handling make this a driver's car.

A DRIVER who racks up mileage in long, hard trips could hardly want better than the '56 Mercury. Agile and competent, it is one of the few U.S. cars that doesn't show the whites of its eyes if you push it hard.

The roadability isn't new this year, but the performance is. A vigorous new 312-cubic-inch engine is under the hood—up 20 inches. It gives showy acceleration. There's no trick at all in clocking zero-to-60 accelerations in 11 seconds,

These clues, plus 20/20 vision, will help you identify the '56s

TWO PEAS in year-apart pods, but with differences. In both front and rear views, the new car is at right. Hood and deck ornaments, grille and tail-light details aid in telling '56s from '55s. In the side view, at top of the page, the chrome swoopery is now curved.

Engine and Performance

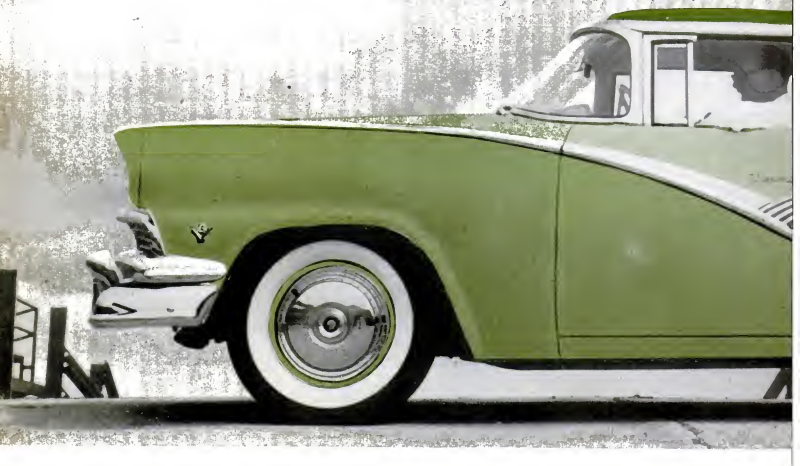
even with an automatic box. The engine comes in three compression ratios, depending on transmission and model—8:1, 8.4:1 and, on automatic-drive models, 9:1. Horsepowers range from 210 to 225.

One reason that the car is goosey is that the rear-axle ratios (3.15, 3.73 and 4.09) haven't been changed with the new engine. But the automatic-transmission shift points are up a bit; the first-to-second full-throttle upshift, for example, now comes at 41 m.p.h. instead of 36.

AUSTERITY MODEL, an unfancied-up Custom two-door, is new this year. Called the "Medalist," it will be list-priced around $2,000

Hill-climb race, up steep test grade, is won going away by '56 model

New Ford: Bigger

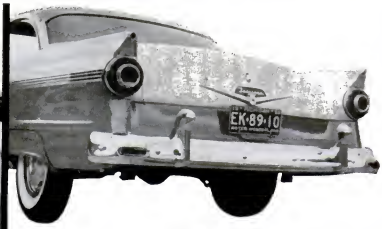


The displacement climbs still higher on the Fairlane and station-wagon models. Also new are 12-volt systems and automatic chokes.

IN THE second year of the life of a body shell, according to the peculiar laws of evolution that apply in Detroit, little change in appearance may be expected. The rule works beautifully for the '56 Ford; you'll have to care to tell it from a '55.

More motor. Under lots of hoods, though, there's a difference. On the Fairlane and station-wagon lines there is a

For '56 recognition: flattened turn lights up front, chrome rings in the tail lights out back



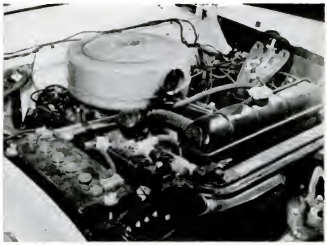
Engine, Slicker Looks

292-cubic-inch engine, the same size as the one that urged the Thunderbird and Merc in 1955. Fitted with a manual-shift or overdrive transmission, it has a compression ratio of 8:1; with an automatic box the ratio goes to 8.4:1. A four-barrel carburetor and dual pipes are standard. The hotter version may be rated, if competition demands it, at 202 hp.

Buyers of Mainline and Customline cars, a more sedate or parsimonious crew, may have a 272-cubic-inch engine, the same size as in '55. It has a two-barrel carb, a single exhaust system, and the same compression-ratio combinations.

Also continued this year is a six-cylinder engine of 223-cubic-inch displacement. It has 8:1 compression and a one-barrel pot. Engineering has okayed it for all transmissions and body styles, but the probability is that there won't be many Fairlane or Country Squire sixes.

Performance. The big new engine provides noticeably brisker getaway. Zero-to-60 times with three people in an automatic-shift model hover around 12.1 or 12.2 seconds. Though this is fully as fast as can be desired, it doesn't seem remarkable considering all those cubic inches. And it may not outrun Ford's



THE 20 MORE INCHES aren't visible at a glance under the hood. Note the new battery. This is a test car; production ones are a bit neater.

NEW INSTRUMENT PANEL eliminates the skylight over the speedometer, which now nestles under a deep hood. Seat belts and padded dash and visors on this convertible are optional extras.

THREE SIX-FOOTERS can fit in the rear seat of the Crown Victoria without sardining. But profile of car (top of previous page) doesn't show any less of the slinky look buyers like.

closest competitor, now a remarkably zippity car. Only green-light cowboys will care, of course, because the car performs sassily enough for anyone else.

One '56 change will gladden the hearts of Ford fans. This is an improvement in the usable passenger space in the Crown Victoria, the sporty-looking hardtop. In 1955 it looked fine but provided comfortable back-seat accommodation only for pygmies. This year you can be normal.

There are other changes:

- A 12-volt ignition system. It gives the engine usefully higher cranking speed.
- Automatic chokes on V-8 models. Dogged last-ditchers may find solace in the fact that the six still has a manual choke.
- Touch-up changes in the power plants and drive trains. These include such things as increased valve lift, a new distributor control diaphragm, and some modifications in the differential. The engine takes slightly larger radiator capacity, and front-wheel weight is up a trifle.
- Station-wagon handling on curves is improved by a new front sway bar.

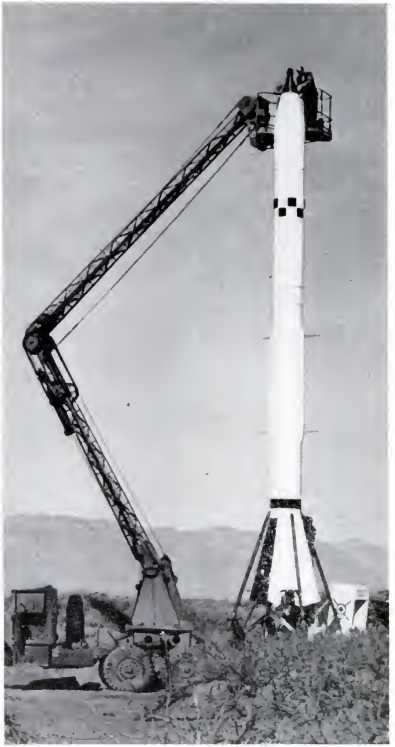
In summary, the personality split among Fords continues to deepen. The lower two lines remain solid, slightly stodgy citizens of the automotive community. The upper two lines, with a bright flush of megalomania, are panting off after the fat middle-price market. END

The doughty Ranch Wagon of years past has come a long way to this carriage-trade carriage

THE PARKLANE, a two-door wagon, is a new, high-style answer to Chevvy's Nomad. Interiors are of such elegance as to discourage any tendency to carry, say, garden fertilizer. A new cloth "tonneau cover" can be put over luggage in back.

Missile Is Serviced From a Cherry-Picker

THIS strange machine was designed to pick cherries in Northwest orchards. Now it has been adapted to hoist crewmen to the nose of a Corporal missile so that they can get it ready for firing. Hydraulically operated, it works from the truck's power take-off. Its official name is "servicing platform," but the men who use it still call it the Cherry-Picker. Stemm Brothers, Leavenworth, Wash., make it.



Paint Sprayer Tags Deer

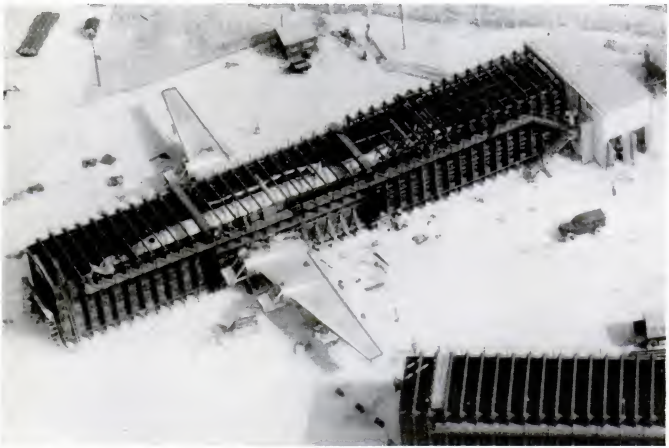
TO FIND out which deer go where, Melvin R. Clover of the California Fish and Game Department colors them. When a deer steps on a hidden treadle, the sprayer above shoots dye at him.

Electric Heating Panels Double as Baseboard

TWO-FOOT-LONG electric heating panels can be installed out of the way in the space ordinarily reserved for the baseboard. You use only as many panels as are required to heat a room. Individual control units make it possible to regulate and vary temperature in each room of your home. Westinghouse says installation of the heating panels requires the same wiring as that used for operating electric ranges.

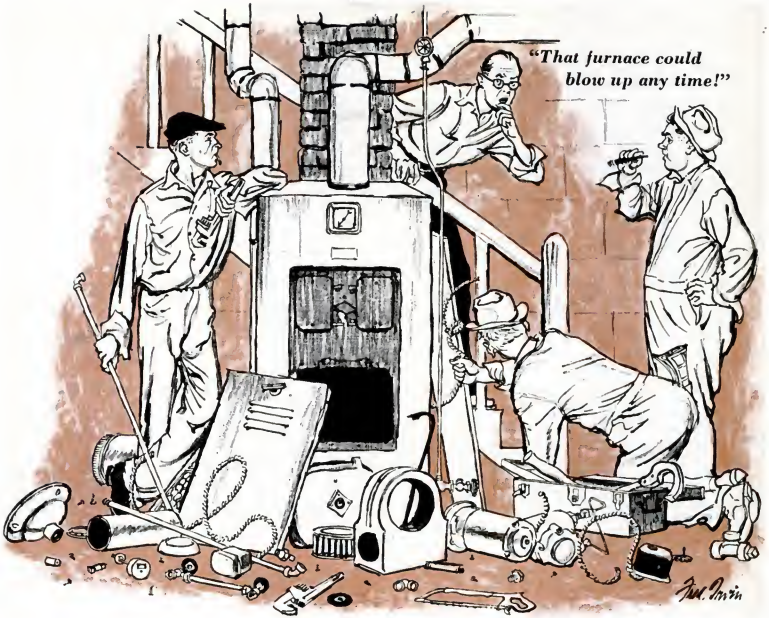
New Gas Turbines Make Old Gunboat a Speedboat

THE old HMS *Grey Goose,* above, has been hopped-up with new engines by the British Admiralty for experimental purposes. After fighting her way through World War II, the gunboat has been refitted with a pair of Rolls-Royce marine gas turbines to make her a floating test lab. Though only half as heavy and three-fourths as bulky as the boat's original steam turbines, they are expected to prove 35 percent more powerful.



Giant Bathtub Puts the Pressure on Turbo-Prop Airliner

TO PROVE that it won't come apart in the air like the ill-fated Comet, this Bristol Britannia is taking a dunking in 300,000 gallons of water. The test tank simulates flights at high altitudes where pressures inside and outside the fuselage vary as much as eight pounds per square inch. Hydraulic jacks under the wings of the 100-passenger airliner apply 20 "gusts" in every three-minute test cycle to see how much stress they'll take.



How to Detect Heating Frauds

Your warm-air system must be properly installed—these tips help you spot bad workmanship.

By John L. Springer

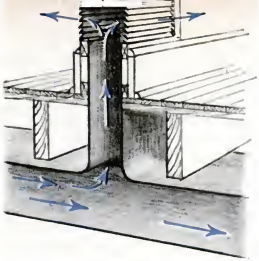
THE man who rang the doorbell told the homeowner that he was a heating-system "inspector." He went into the cellar, poked around and announced that cementing some leaky joints would put the furnace in top shape —a $25 job.

The homeowner paid a $5 deposit. The next day a crew arrived, ripped down the furnace, scattered it over the cellar floor. Then one workman called the homeowner.

"That furnace could blow up any time," the man told him. "We wouldn't even take the responsibility of putting it together again."

Shaking his head, he painted a grim picture of freezing weather, escaping gas, probably a fire, and said the insurance company might refuse to pay losses if it discovered how bad the furnace was. Before he could think calmly, the homeowner signed for a new $500 furnace.

Actually, the old one was okay. But



Only the contractor gains

from an arrangement like the above—one heat riser feeding two registers in adjoining rooms. For adequate heat distribution throughout your house, each register should have its own riser.

the men hustled it away before the homeowner could get an expert to check. This happened last year near Boston.

Such incidents have become common throughout the United States. Officials of Better Business Bureaus suspect one furnace manufacturer's branch managers of pocketing up to $50,000 a year in this way. But you may actually need a new furnace. That's another reason why you should call in only an expert. The American Institute of Management, a nonpartisan organization, reports:

"Unethical practices, chiefly by retail furnace installers and repairmen, are widespread. Furnaces which by the industry's own standards should have been replaced have often been repaired—at the peril of the health and safety of the consumer. Others have been poorly installed . . . Faulty repairs in several cities have resulted in tragic fatalities."

To this, Randall A. Nelson of the National Warm Air Heating and Air Conditioning Association, adds: "While the public is shown vivid pictures about atomic heating of the future, they freeze with the sloppy installations going into their homes today."

The unethical practices center in the warm-air heating industry. I investigated several examples, and encountered much evidence of downright fraud—usually starting with doorbell-ringing, quick-talking salesmen. One woman contracted for a $550 furnace. Instead of a new one she got a broken-down rusty model probably discarded by another homeowner. Another doorbell-ringer hooked a homeowner for a $200 repair job—and fouled up the system so badly that heating bills shot up $100 a year.

Reputable heating firms are worried. They emphasize—correctly—that most contractors are honest, reliable and competent. But the housing boom has tempted some poorly trained mechanics to set themselves up as contractors.

Unlike water-heating installations, usually made by trained, licensed plumbers, warm-air systems can be installed by anyone who calls himself a contractor. And fast-buck boys, according to Edwin A. Scott, editor of the trade publication, *Heating, Air Conditioning and Sheet Metal Contractor,* have bought tin snips and hammers and suddenly become "heating engineers."

Since most people are looking ahead to future air conditioning, and an estimated 75 percent of all new homes now have warm-air systems, it's easy to see why rackets involving this type of heating are so prevalent.

Warm-air heating system faults, however, are often easy to spot. If you're having a new warm-air plant installed, or

It's a bad turn

the builder has done you if you find sharp bends like this in your ductwork. If needed, the bends should be gently curved or angled. (Heating & Air Conditioning Contractor photo.)

having trouble with an existing system, watch out for such defects as:

Dangerous duct work. Some corner-cutting contractors don't use metal ducts to carry warm air from the furnace. They simply nail a strip of metal under the opening between two joists so that the joists themselves form the sides and the subflooring the top. Fire underwriters permit this method to return cold air to the furnace but will not insure a house using it to supply warm air. A wood-duct system probably also costs more in the long run because the heat loss is far greater than with metal ducts.

Inefficient duct system. Some heat is lost in every foot and bend of duct. Short runs without twists and turns are

Keep the air fresh

that goes into your furnace system. It's best to avoid return-air grilles in a heated garage (above), kitchens, bathrooms or other rooms where the air may not always be fresh.

best. If the location of the furnace makes bends necessary, they should be curved or gently angled. Sharp, right-angle turns create greater friction to the air flow—and increase fuel costs.

Separate risers should be provided for each supply register. Some penny-pinching contractors put registers on opposite sides of a partition cut into the same riser.

Short-changing on return-duct sizes also is common. For the air to circulate through the house and the furnace in an even stream, the diameter of return

A furnace needs air

for good combustion, or you will waste fuel. So don't try to tuck the furnace away in a crowded closet. In the installation shown here louvered doors let enough air in.

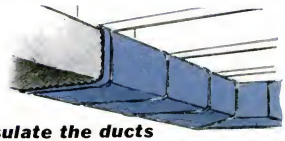
ducts should equal that of supply. (In perimeter systems which shoot warm air through four-inch ducts at high velocity, return ducts should be twice the size.)

Fouled-up air supply. The air fed into the furnace should be good. One contractor ran heat to a garage and also installed a return duct there. Whenever the homeowner started his car, exhaust gas was drawn into the ducts and spread through the house. Experts also frown on return-air grilles in bathrooms, kitchens, laundries and the like.

Sloppy workmanship on ducts feeding air to the furnace can boost fuel bills. In one house, the contractor left open seams in a duct through unheated crawl space. Zero air streamed in, and the furnace worked overtime. By plugging the ducts, the homeowner estimated he saved $60 a year.

Hot air blasts. In some warm-air installations, a house may become alter-

[*Continued on page 262*]



Insulate the ducts

and you'll be able to move more warm air to the spots where you want it. But be sure the insulator is applied properly; poor insulation can actually increase heat loss.

CIGARETTE-PACK RADIO plays through earphone (left) or through a speaker in its leather carrying case (above). Made by Capehart, it weighs just 6.4 ounces, gets it power from four hearing-aid or mercury batteries.

Transistors Take Over Portables

YOU can now buy portables that are really portable—thanks to transistors, the tiny-as-a-pencil-tip replacements for vacuum tubes. There are several new radios and even a transistor phonograph.

One new radio, the Capehart, also runs on house current when you plug it into an ash tray that conceals a speaker. Another, by Raytheon, is a table-model radio you never have to plug in—it will operate two years on one battery.

SINGLE BATTERY of the type used in hearing aids provides juice for the Mitchell transistor portable above. It has a 2¾-inch speaker that can fill a room with sound.

TRANSISTOR PHONOGRAPH by Philco will play 3,000 standard 45-r.p.m. records on power from four flashlight batteries. Its four-volt turntable motor weighs less than three ounces, is one-fifth size of conventional motor.

A NATIVE CANOE carries one survey team along a river in Colombia. Local civilians do most of the field work, using age-old transport methods to conquer the wild terrain of South America.

CLIMBING WOODEN TOWER, a surveyor sights along a base line in Cuba. Using such lines, surveyors have laid out 40,000 miles of precise triangulation measurements so far.

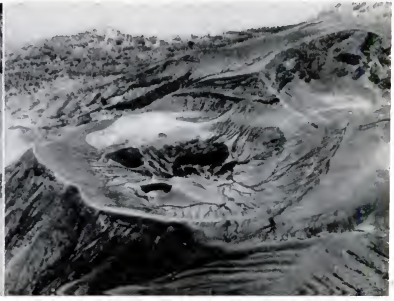
Surveyors Rechart Wilds for New Map

MOUNTAINS a mile high are being added. The Amazon river is being moved up to 20 miles, and the Isle of Pines shifted 15 miles. Such changes in the map are being made by the Inter-American Geodetic Survey's field crews, who are now recharting 42,000,000 square miles of Central and South America.

About 5,000 workers, ranging through jungles and deserts, are eliminating historic errors in charting. One man has died of heat in the desert, one has frozen to death on a mountain, and a third has been devoured by a jungle pig.

SIX-FOOT RAT SNAKE and a 10-foot boa constrictor are live training aids in the jungle survival course given survey teams at the Army's Jungle Warfare Training Center in Canal Zone.

IRAZU VOLCANO IN COSTA RICA was mapped with the aid of a light liaison plane often used in rough country. Complete aerial mapping program is next step in Survey's long-range plan.



How You Dial

Three extra twirls let you phone directly, of miles away. This year DDD—Direct

A code of three numbers identifies each area . . .

You dial these digits plus

By Frank J. Taylor

WILLIAM FREYLINCK, plant service supervisor of the ultra-modern Englewood, N.J., telephone exchange, was showing me the amazing "brain center" that was installed there four years ago. It looked like a pile of diminutive metal books within great stacks of cases connected by a tangle of bright-colored wires. Pushing a dial phone across his desk, Freylinck asked, "Know any number out West you can call?"

"Sure, I know a good number near San Francisco," I replied.

"Okay, dial it and see what happens," he said, pulling a stopwatch from a desk drawer.

Starting with the figures 4-1-5, call prefix for the San Francisco area, I dialed my home, a typical seven-digit number. Within 25 seconds I could hear the phone ringing 3,000 miles away. My wife could scarcely believe her ears when I told her I had dialed her as easily and quickly as if I were phoning from across the street.

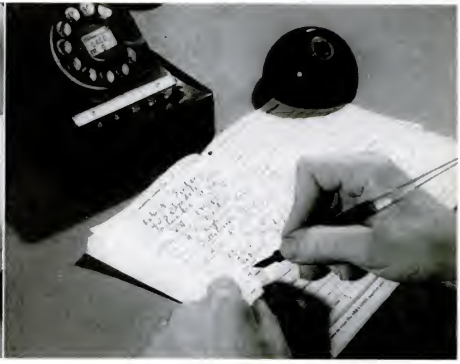
But Freylinck was apologetic: the average time to complete a call from Englewood by DDD (Direct Distance Dialing) is 18 seconds. The more direct circuits may have been busy, he explained, and the brain center had lost seven seconds setting up the connection, perhaps by way of St. Louis or Dallas or some other indirect route possibly 5,000 miles long.

Direct Distance Dialing is no longer an engineers' dream. Ten thousand customers of the Englewood exchange have been using the revolutionary new service since November, 1951. Up to a quarter-million customers of a score of other suburban exchanges have been dialing long-distance calls for a shorter period. By the end of this year 56 communities will have DDD, and early in 1956 the first two large cities, South Bend, Ind.,

Coast to Coast

without an operator, to people in cities thousands
Distance Dialing—is being extended to 56 new areas.

the local exchange and number . . .



And note it, to be ready for easy calling next time.

and Hartford, Conn., will switch over. After that, the remainder of the country will go DDD as rapidly as a modernization program costing billions of dollars can be completed, and ultimately all of us will be able to dial directly almost any of the 58 million phones in the United States and Canada.

The Bell Telephone System's DDD robots, which can hear, memorize, communicate and perform other human functions with vastly more than human speed and accuracy, were first tested in Englewood and other suburban areas because these fast-growing sections already had the latest in equipment, and the change-over to DDD would not be unduly time-consuming or costly. "We were confident that the machines in these pilot exchanges would work," Freylinck says. "What we didn't know was how the customers would like the arrangement."

Customers reacted to direct dialing so enthusiastically that the 21 associated operating companies in the American Telephone and Telegraph network (with 46 million phones and 42 million miles of circuits), most of the independent U.S. companies (with eight million phones), plus the Canadian companies (operating four million phones), soon decided to go ahead with the distance-dialing revolution, costly though it might be.

Engineer John Meszar of the Bell Laboratories recalls that the system's technicians realized, as long as four decades ago, that they *had* to invent robots. At the rate that Americans and Canadians were talking, more telephone operators would eventually be required than could be found. Today, even with automatic dialing, the Bell System requires a quarter of a million operators to handle collect, person-to-person, information-please and other nonautomatic calls. Bell expects to employ more, rather than

MARKER, a complex of circuits that helps guide your call through an exchange, is checked at Bell Labs. Type shown is designed for one of the country's 60 major switching centers.

TRANSLATOR FRAME identifies the telephone dialing a distant call. Your call may pass through dozens of units like this one, each with a specific job to do, in only a few seconds.

fewer, operators when DDD blankets the country.

These brain centers are superior in many ways to the human brain, says Meszar. "What the human mind can do in a second, the mechanical brain can do in a hundredth of a second. The best-trained human mind becomes unreliable at high speed and under a heavy load. The mechanical brain can work reliably 100 times as fast—and without fatigue. In developing it we kept asking ourselves, 'What steps would the human mind follow to solve this problem, and how can machines do it faster?' "

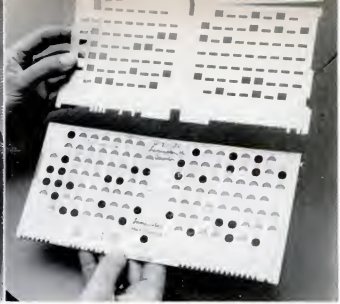
The result, worked out through the years in terms of astronomical numbers of crossbar switches, magnets, blinking lights, tubes and transistors, is staggering. "And everything we developed," Meszar points out, "had to be modified to fit into what we already had at hand. In the telephone business, nobody has ever made a fresh start but Alexander Graham Bell."

One of the perplexities was telephone numbers. They ranged from three to seven digits in different parts of the country. As dial phones were installed, many exchanges had to switch to the seven-digit standard, such as MAin 5-9970. This brought protests from customers who cherished unusual numbers such as 555 or 711, or numbers which reminded them of birthdays or anniversaries. And even with a seven-digit system, there were not enough combinations possible on the dial to give each of the 58 million customers a different number.

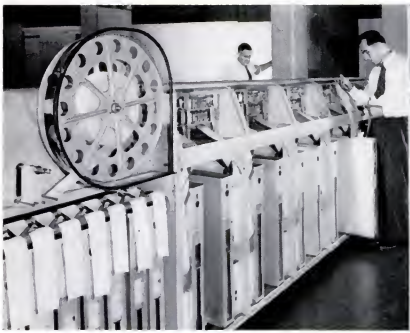
So the country was divided into 101 code areas, each with a unique prefix, such as 4-1-5 for the San Francisco area, 3-1-2 for Chicago and vicinity, 5-0-4 for Louisiana. Some populous states required several code areas: New York has seven; Texas five; Ohio, Illinois and Pennsylvania four each. Within some areas, a few exchange names and identifying numbers had to be eliminated because no two exchanges in a code area can have the same three first digits. For example, in the 4-1-5 area, the San Francisco region, there could not be MAin 8 and MArket 8 exchanges, because the DDD brain could not distinguish one from the other.

To expedite the nationwide phone-number overhaul, the AT&T specialists offered to all operating companies, both Bell and independent, a list of preferred exchange names, easily understood all over the country. In the change-over, many historic exchange names are being dropped. This, too, distresses local customers, who lament, "What's the matter with Cynwyd? We like the name."

Cynwyd, pronounced "Kinwid," may have been easy for Philadelphians to



NO MORE "CIRCUITS BUSY." Waiting for a long-distance trunk is ended by card translators (above left), which can choose from many alternate routes between two cities to complete a call. Routes are coded as holes in metal "card" (above right) which translator reads with light beams. Cardboard template (in hand below card) guides press that prepares card.



TO CHARGE YOUR BILL, tape-puncher (above right) notes calling and called numbers, date, and time conversation began and ended. Information on hundreds of calls is mixed together, later straightened out by other machines (above left) that sort tapes, read them and print bills. Big reel at far left can hold tape recording data on 25,000 individual conversations.

remember, but strangers too often dialed it KI. The same is true of double names, such as MUrray Hill, often dialed MH.

In the area codes, the middle digit is always 1 or zero, because these spaces on the dial were not utilized for exchange-name letters in the seven-digit numbering plan. The 1 space and the zero were reserved for operator codes. This was a lucky break for the DDD designers. Now when the "brain" picks up a 1 or zero on the second twist of the dial, it senses instantly that a long-distance call is coming up and automatically stores up the rest of the 10-digit number.

The robots thereupon begin functioning in split-second flashes. From the originating exchange the call is flashed to a switching center in its code area. Here one section of the "brain" (its "memory") stores up the dialed number, at the same time informing another section (the "searcher") about the destination of the call. The "searcher" begins a lightning check of circuits—sometimes hundreds of them—for one that is available to the destination area. Having found one, it seizes it, and over it "memory" flashes the stored-up number to the des-

[Continued on page 274]

Jet Seaplane Whooshes Over Bay on Single-Ski Landing Gear

MAYBE a plane can't fly on one wing, but here's a jet fighter taxiing at high speed for a take-off on a single broad ski. The refitted XF2Y-1 Sea Dart has been cutting through the waters of San Diego Bay to test the odd landing gear for a Convair-Navy research team. The delta-wing Sea Dart—first jet seaplane ever built—packs twin Westinghouse J-46 engines that can boot it along at high subsonic speeds in ordinary level flight. Test pilots have also hurled the fighter through the sound barrier.

Missiles to Stalk Prey

SLIM and deadly, the Swiss Oerlikon AA guided missiles above pack 770 pounds in their 19-foot length. They're beam riders with a maximum guidance altitude of 9.4 miles. Radar tracking from the ground puts the beam on the target.

Hybrid Transport Flies Vertically

THE National Advisory Committee for Aeronautics is experimenting with this model of a vertical-flight transport. A monoplane, its wings pivot to point the props up like rotors for take-offs and landings. Two banks of tiltable slats slide from the wing to deflect propwash down and add lift. Wing flaps also help get the craft off the ground.

Oil Drill Works Under Wraps

THIS oil-well rig is located on the outskirts of Maracaibo, Venezuela's second largest city. To quiet down the roar of drilling operations, the derrick wears a special "anti-sonic" shirt. The gaudy red and white stripes were added to the cover to warn off planes headed for the airport close by.

Magnet Helps Doctor Snag Pins

THE X ray above shows how doctors at Ponce de Leon Infirmary, Atlanta, recovered four metal bobby pins from the stomach of a two-year-old girl. Held by a curved GE magnet on a string, all four pins were drawn out at one time, through the throat of the anesthetized child, with fluoroscopic help.

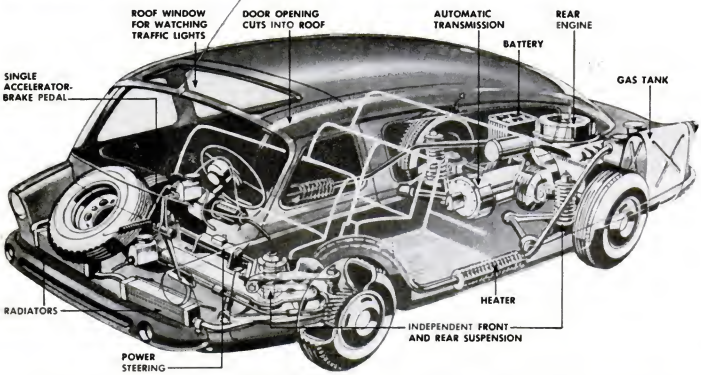
Plug-In Piano Folds for Travel

HERE's an 85-pound electric piano that folds up so you can carry it like a suitcase. A Wurlitzer with 64 keys, it can also produce special effects to sound like a guitar, bass fiddle or harpsichord. Earphones plug in for silent practice sessions.

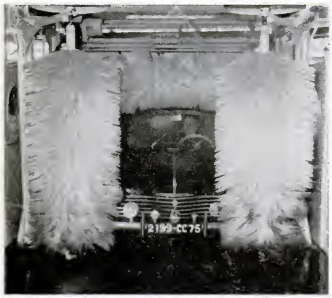
Skeleton Plane Dusts Crops

THIS crop-dusting biplane is designed for use with any war-surplus radial engine. Tests will determine whether that naked rear section should be covered and fin and rudder changed. Larson Aero Development, Concord, Calif., is the builder.

Russian's Dream Car Has Automatic Brakes



THE Russians say they have this "dream car" on the road. The NAMI-013 is turtle-shaped, with automatic braking and a rear engine. The double radiator is up front, however, connected to the engine by pipes that pass through heaters to warm the passengers. The brakes seem similar to the Hemphill device recently announced here (PSM, Sept. '55, p. 121)—when you let up on the accelerator, the brakes take hold automatically.



Big Brushes Clean French Cars

AN ULTRAMODERN garage in Paris scrubs up cars in five minutes with an Italian-developed contrivance. The cars run on rails through a tunnel where they are sprayed with water and worked over by giant nylon brushes rotating at the sides and on top. The garage, which is being used although it is only partly completed, will house 1,500 cars.

"Hot" Machines Cooled in Bath

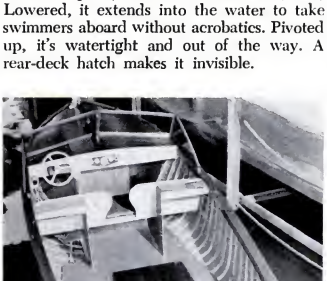
THIS is how you fix a machine contaminated by radioactivity. Repairmen at the Hanford, Wash., atomic plant wear masks and protective clothing while they work on equipment under water. Their hands enter the plastic tank through ports fitted with rubber gloves. The water shields the men by absorbing dangerous atomic radiation.

Boatmen Launch Their '56 Models

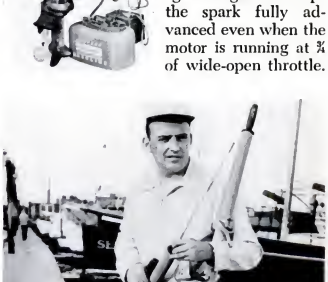
Boarding ladder is built into the transom of this Capri. (It comes on outboards, too.) Lowered, it extends into the water to take swimmers aboard without acrobatics. Pivoted up, it's watertight and out of the way. A rear-deck hatch makes it invisible.

Bring-'em-back-alive fish bag clamps athwart the gunwales of a boat to hold two rods in fishing position—and keep the day's catch in good condition. Hoops 12 inches across open the net wide at the top and give fish moving space at the bottom, which trails in the water. Grooved steel rings hold the fishing rods in proper place.

This glamorized 30-hp. outboard, painted bronze and white with stainless-steel trim, will replace Johnson's 25 next year. All the Javelin's controls are hidden. There's an electric starter, and a fuel saver said to hoard gas at cruising speed. A linkage arrangement keeps the spark fully advanced even when the motor is running at ¾ of wide-open throttle.



V-drive on this 65-hp. inboard lets you put the engine far aft in a small boat—placing the weight almost where an outboard would hang. This is made possible by a gear-driven propeller shaft angled down from the front of the engine.



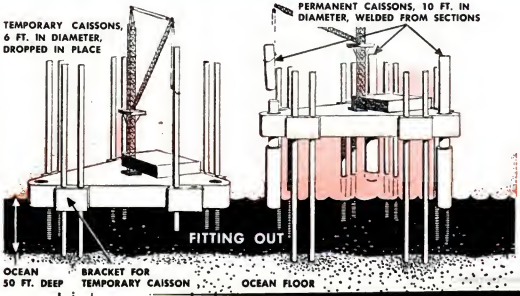
Double-duty oar stores your fishing rod in its hollowed-out length. Just remove the handle and shove the rod in. The hollow center makes the oar light and buoyant, and reinforced plastic keeps it from warping, splitting or becoming waterlogged.

Further information about the products described on this page can be obtained from: BOAT: Olympia Yachts, 701 Whittier St., Bronx, N. Y.; BAG: Alliance Mfg., 3121 Milwaukee Ave., Chicago; OUTBOARD: Johnson Motors, Waukegan, Ill.; INBOARD: Universal Motor Co., Oshkosh, Wis.; OAR: Plastic Age Reinforced Products, San Fernando, Calif.

Radar Island Rises 110 Miles at Sea

Island floats out, climbs up on stilts

Platform was built ashore like a ship, with 15 tubelike caissons towering 195 feet in air along sides. At site, caissons were dropped to sea bottom and platform, riding them, jacked up. Finally, 12 caissons were removed, leaving three, concrete-filled, as permanent supports.



Texas Tower 2 will keep a wary eye on the sky for first sight of an enemy.

By Hartley E. Howe

PSM PHOTOS BY W. W. MORRIS

TAKE 6,000 tons of steel and fashion it into a triangle 200 feet on a side. Move this clumsy pie slice 110 miles into the open Atlantic. Hoist it up in the air so its bottom is 67 feet above the sea. Prop it there on three huge steel toothpicks stuck into the ocean floor. Do the whole job in the few scant weeks between the last spring gale and the first hurricane. And do it in waters too rough for normal floating construction equipment to operate.

Plugging a gap. That was the challenge faced by the engineers who designed Texas Tower 2 and raised it above the revolving tides of Georges Banks, off Cape Cod, to plug a gap in our radar defenses.

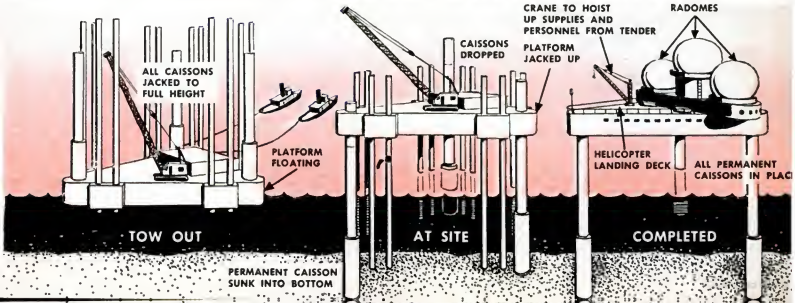
Texas Tower 2—the number refers to the site, a long way from Texas—rises altogether 83 feet in the air and 133 above the ocean floor. It is the first of a chain of radar stations to be built along the continental shelf off the east coast of the United States. For delicate electronic detection devices they will provide

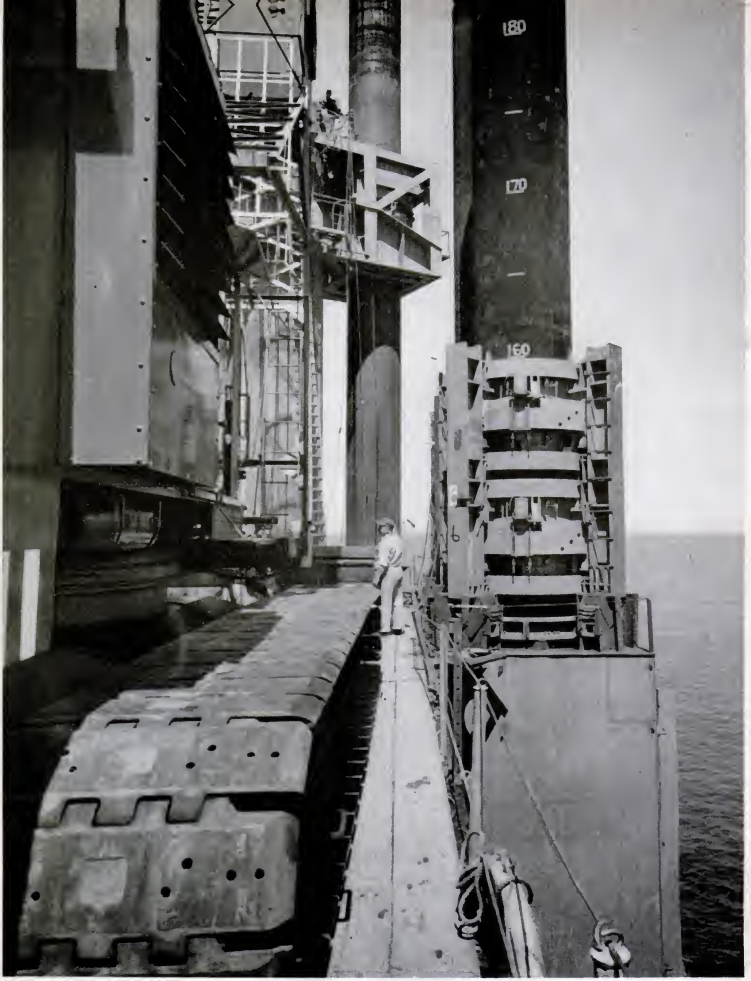
[Continued on page 268]

VISITORS TO ISLAND ride up in "basket," a big rubber ring with railing, lifted by crane. Water is usually too rough for ships to moor against legs of the island.

CATWALK swings around underside of platform, riding track at outer edge and pivoting at center. Crew use it to inspect the island bottom, otherwise inaccessible.

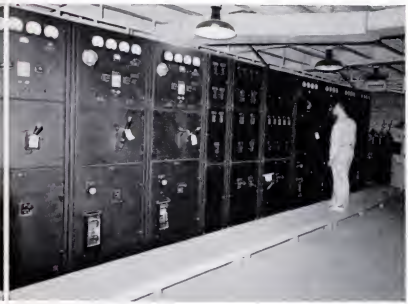
Please turn the page for more radar-island photos



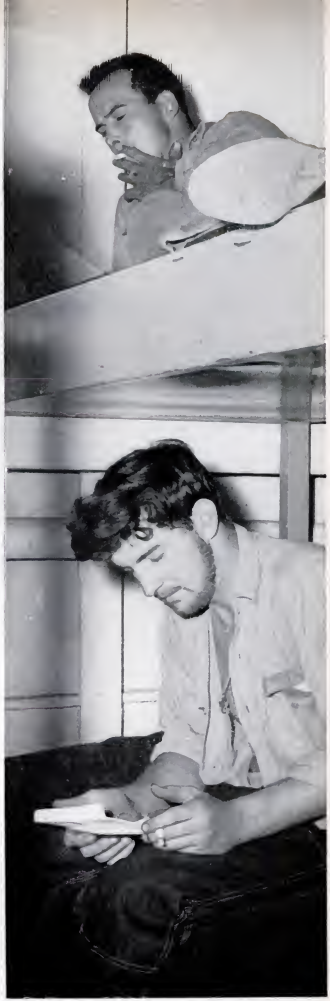


PLATFORM SHINNIED UP its caisson supports like boy climbing a tree, using special jacks as its arms and legs. Each jack consisted of two steel collars circling the caisson and separated by a rubber bellows. (Collars are at center right in photo above.) Lower collar was first made tight to caisson. Upper collar was fastened to platform. Compressed air then inflated rubber bellows, pushing top collar up the caisson and raising the platform. Top collar was finally tightened around caisson while the lower collar was slid up for the next "push-up."

EVERYBODY GOT IN THE ACT. Radar island, part of vast network to detect enemy air attack, was built for the Air Force by two civilian firms under Navy supervision. That's Cmdr. John J. Albers of Navy Civil Engineering Corps above checking plans with an engineer.



LONG BANK OF DIALS AND SWITCHES is control panel for diesel-generated electricity used for lights, power, electronic detectors. Panel is on upper deck, which also contains mess hall, cabins, workshops. Radar equipment will be in deckhouse, with radar antennas on the roof.



CREW QUARTERS, comfortable four-man cabins with double-decker bunks and lounging areas, were used by construction workers. They worked 12-hour, seven-day week in rush to complete island before winter storms hit. Pay often averaged $300 a week—with no place to spend it.

One Horsepower Eyes 1,650 Horses in Car's Spitfire Engine

This pile of junk hits 110 in second gear. A Rolls-Royce Merlin engine that once powered a wartime Spitfire charges the nervous heap with 1,650 horsepower. London garage-owner Michael Wilcock, who assembled the car from scrapped parts, says his Spitfire Special could do 160 m.p.h. in third gear and eventually 430 in fourth. Warming up for three minutes, the monster engine gulped eight gallons of gasoline.

Chemical Mist Covers Water to Keep It from Evaporating

African scientists hope to save hundreds of millions of gallons of precious water by preventing it from evaporating in the hot sun. They are covering reservoirs in Kenya with a mist one molecule thick of a whale-oil chemical. This compound, cetyl alcohol, has reduced evaporation more than half in tests. Pellets of the alcohol in box rafts (left) float on the lakes, emitting their evaporation-stopping film. The alcohol is said to be harmless to plants and animals.

Who invented color television?

Just about everybody had a hand in the job, including Ben Franklin, the Russians, and the ancient Greeks.

1752 Franklin American
Identifies "positive" and "negative" electrical charges

1800 Volta Italian
Develops the first electric "pile," or battery

1819 Oersted Danish
Demonstrates that electricity can magnetize

An urge to extend man's sight and hearing beyond his human limitations

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Discovers "induction"; conceives magnetic "lines of force"

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Discovers phenomenon of electrical "self-inductance"

1827 Ohm German
Examines relationship of current, voltage, and resistance

1825 Ampère French
Establishes mathematical basis for electrodynamics

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Passes electricity through vacuum tube

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Transmit picture b

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1876 Bell Amer
Patents fi telephonic device

1831 Henry American
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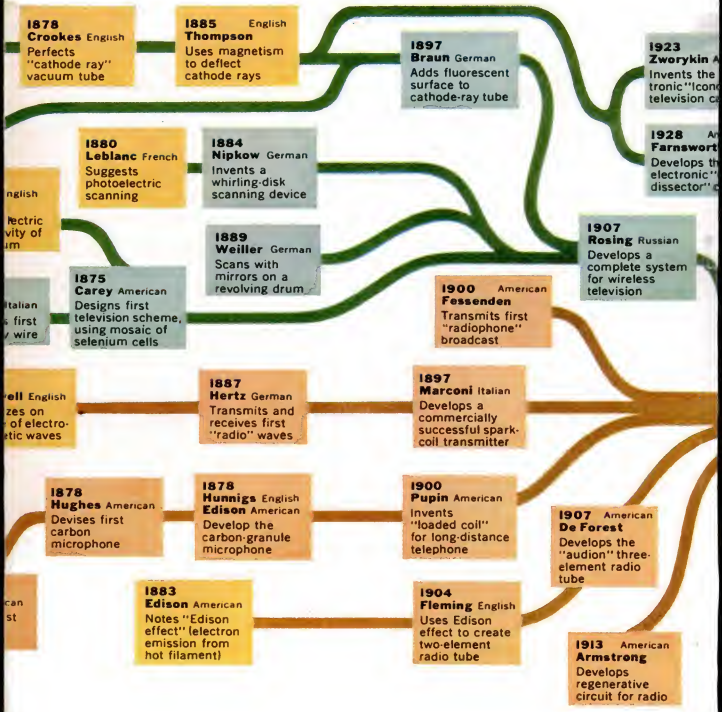
Scientific discoveries

Inventions leading to

IF YOU had the idea that some horny-handed inventor took a fistful of wires into his barn and came out months later with a television set, just take a look at the chart below. Many men "invented" television, and the new color sets are the fruit of a family tree that goes back two centuries to that well-known inventor Benjamin Franklin. It could be traced back even before Thales of Miletus, who studied static electricity 2,500 years ago.

Actual television—pictures transmitted over some distance—began right after the electric telegraph. In 1862 the Abbé Caselli sent a drawing by wire from Amiens to Paris. By 1884 Paul Nipkow patented a



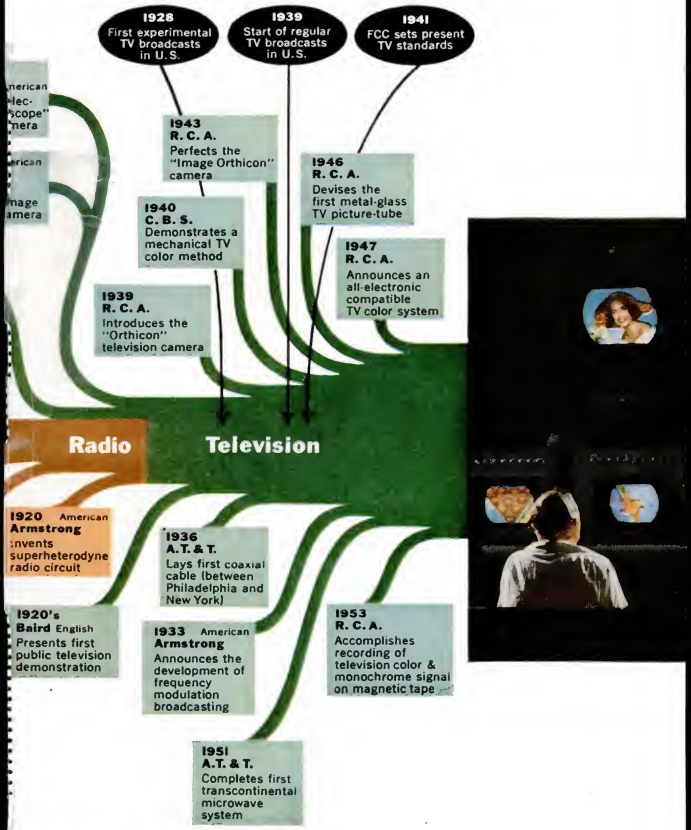
radio

Inventions leading to television

Drawing by Max Gschwind reproduced from FORTUNE, December 1954.

whirling-disk scanning device for cameras and receivers. It led to a hectic, short-lived television industry in the late 1920s—with 15 stations in the U.S. alone. Even transatlantic television, which most people still consider a dream of the future, has already been accomplished. In 1928 John Baird transmitted a woman's image—live—from London to New York.

But mechanical TV was too crude. It took the delicate touch of an all-electronic system, thought up by a Russian, Boris Rosing, in 1907 and later developed to practicality by many men in many countries, to give us the magic color window on the world we now enjoy.



opyright Time Inc.

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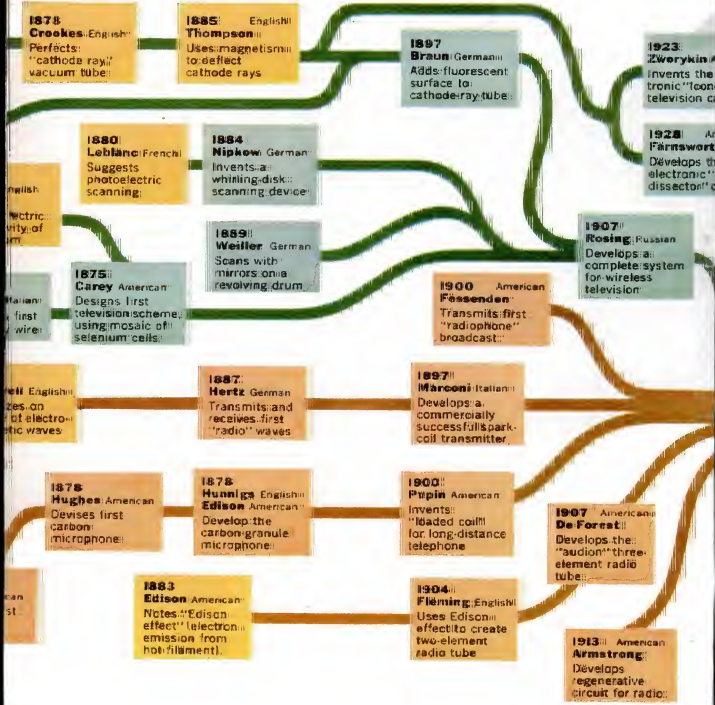


radio

Inventions leading to television

Drawing by Max Gschwind reproduced from FORTUNE, December 1954.

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Foldout slip-sheet

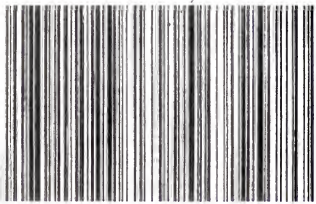
Folded edge of the page

Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

1. Follow instructions on the other side

Inverted Back



Back

1. Follow instructions on the other side

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Scientific discoveries

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For $150 and a bit of work you can have

Color pictures

on your present television set

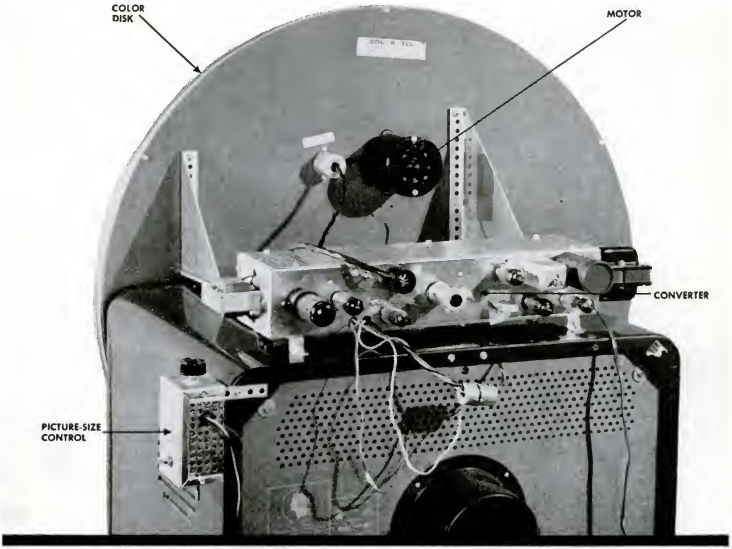
A converter you install without pulling the chassis puts color on the same tube you are now using.

By Hubert Luckett

COLOR television for you may be as close as the set you're watching now. With a new converter hooked to that same black-and-white receiver, you can see colorcasts in color any time they're on.

You just take the circular viewing unit out of the closet, place it on the set, plug it in, and throw a switch. Those big-time color shows you formerly saw in monotone will blossom into brilliant hues.

The outfit costs about $150. If you install it yourself, this is all it should cost to put your family into the color



THESE PARTS ADD COLOR. The converter can be mounted either on top of the set as shown here, or vertically behind the cabinet, thus leaving the top entirely clear when the color disk is removed. This wheel unit, which rests on rubber feet and requires no fastening to your TV set, can be disconnected and quickly removed for black-and-white reception.

picture. It's a bargain compared to the price of a separate color receiver, or even to that of a "slave" unit (with its own costly tricolor picture tube), which was once thought to be the answer to conversion of black-and-white sets.

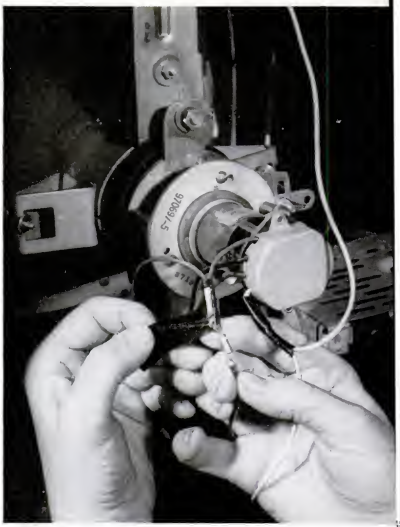
Are you ready for it? The converter can get color only if your local stations transmit color; it will not add color to ordinary black-and-white broadcasts. So before unbuttoning your set or checkbook, think hard about two things:

- Are the stations you now get sending color programs?
- Does your set get those colorcasts in really excellent (not fringe-reception) black-and-white?

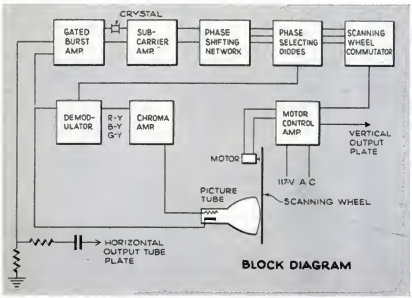
Only if both answers are yes will the converter do anything for you.

Picture is resized. Although the outfit can be used with any size TV screen, it funnels the picture down to approximately what you would see on a 14-inch tube. This is a practical compromise to keep the viewing unit to manageable size—31 inches in diameter. (For a 21-inch picture, the wheel unit would have to be nearly four feet in diameter.) Of course the diminished image bounces back to full-screen size when you switch to black-and-white again.

How it's done. The earlier CBS system viewed the studio scene through three color filters in rapid succession. At home, you looked at the screen through a revolving disk with filters of the same colors. Properly synchronized, these changed the color of the image at each frame while the eye blended the three color images into one of natural hues.



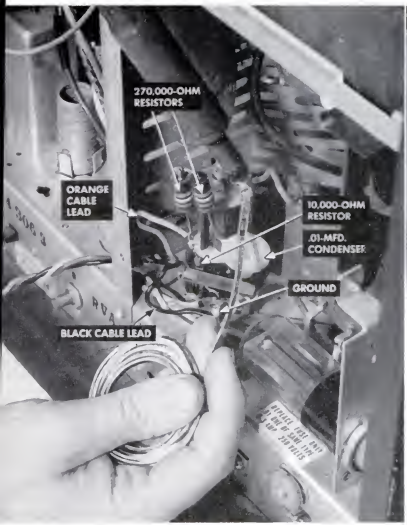
THE COLOR SIGNAL may be available at either the grid or cathode of your picture tube. Splice the yellow plug-in lead to whichever is fed the signal in your set. Cut the other lead (from grid or cathode as the case may be) and solder in series with it a 47,000-ohm resistor. Splice the green plug-in lead to this resistor on the side which is nearest to the tube.



BLOCK DIAGRAM

Here's how it works:

TECHNICALLY speaking, the color signal is taken off the picture tube, demodulated, amplified, and then energizes a crystal to produce a steady subcarrier voltage. A network shifts this to three voltages differing in phase by the relationship between the three colors. Through switching diodes controlled by the color-wheel commutator, the voltages are fed back to the picture tube, providing proper brightness for each color.



THREE CONNECTIONS hook a voltage divider up to the horizontal output tube. Solder the free lead of the ceramic condenser directly to the plate cap, as above. The orange lead from the converter goes to the joint between the two 2-watt resistors and the ½-watt resistor. The lower end of the latter and the black converter lead are grounded to the cabinet frame.

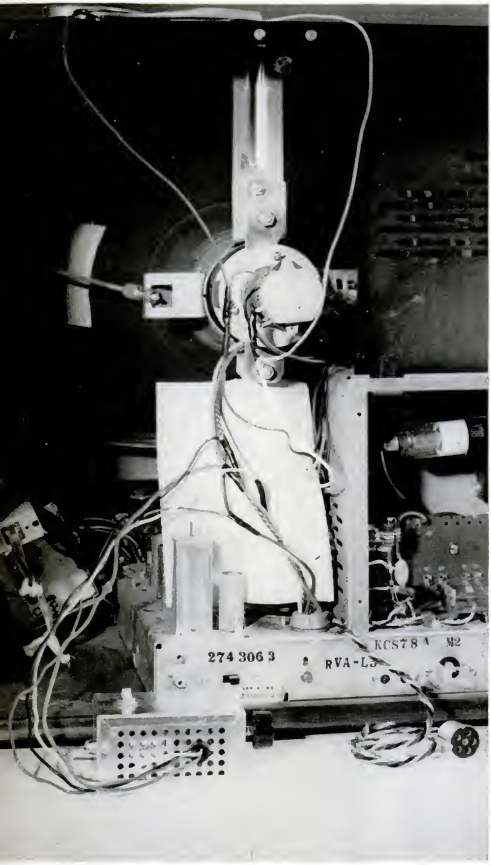
A BLUE WIRE from the converter must be connected to the plate of the vertical output tube. This is done from above the chassis by pulling the tube out and slipping a coiled spring clip on the plate prong, as above. Pulses from this tube, fed through a two-stage amplifier, control motor speed to synchronize the color wheel with framing frequency. Result—an image.

The now standard compatible NTSC system sends a color picture that comes in as a black-and-white one on any non-color set. The matching color receiver has a special picture tube with three electron guns, plus a screen having thousands of phosphor dots of the three primary hues. A shadow mask and appropriate circuity allow each beam to hit only dots of its corresponding color. The picture thus consists of a mosaic of fine color dots, like some color engravings.

The Col-R-Tel converter uses the image on an ordinary black-and-white tube. Feeding back to the tube video information that the set would otherwise ignore, it keys the single electron beam to the proper illumination for each color at each spot on the screen. Then it locks a three-color filter disk in step with the framing frequency, somewhat like the CBS system, producing a color picture.

Got a soldering iron? Installation is simple if you have the wiring diagram for your TV set and know how to read it. Only 10 connections have to be made to the receiver, none of them below the chassis. But you must be able to identify the picture-tube leads, and you must know whether the video signal in your set is fed to the cathode or the grid of this tube. So it isn't a job for anyone utterly inexperienced to tackle without competent help.

Of course the set must be in good condition for black-and-white reception, and properly aligned. If its band width is less than it should be (noticeable by loss



ALL REMAINING CONNECTIONS are made to the deflection coils. The red lead from the picture-size control box, shown at bottom of photo at left, goes to the high-potential side of the horizontal deflection coil. Black lead goes to the low-potential end of this coil. Green and yellow leads from the same control box are spliced in parallel with the vertical deflection coil. Polarity in this case is unimportant; either of the latter leads can go to either side of the coil.

of fine detail in the black-and-white picture), there may not be enough color signal to work the converter. Older sets, which have wider IF bands than some current ones, will produce better color images.

There are only three main parts to the outfit: a seven-tube converter, which can be mounted behind the TV set with its controls accessible from top or side; a picture-size control box that includes the switch; and the scanning unit, a circular case containing the color-filter wheel, a small motor and a commutator.

Tuning in to color. Only three extra controls are involved in switching to a color program. With the scanning unit in place, the switch on the control box is turned to "color." The picture is then tuned to its sharpest with the fine tuning control, contrast and brightness being turned up somewhat higher than for black-and-white reception.

Next the converter is turned on, the motor starting switch held down until the wheel reaches its full speed of 600 r.p.m., and speed adjusted so that the filter seams disappear. The color-gain control is set for the desired amount of color, and the color lock control is finally used to key the proper color to the various elements of the image on the screen.

On some sets the best color rendition may be obtained by slightly detuning the fine tuning control.

The Col-R-Tel converter is manufactured by Color Converter Inc., of Columbia City, Indiana. **END**

New TVs Are Easier to Handle

An easy-to-carry portable provides television in any room in the house. This 14-inch General Electric model weighs only 32 pounds, has a carrying handle at the top of the steel cabinet, and uses a built-in antenna. Like many other 1956 sets, it is built largely of automatically manufactured subassemblies—50 per cent of the circuits are printed and 80 percent of all connections are machine-soldered.

A periscope dial shows the channel numbers under a magnifying lens built into the top of some new Admirals. It is illuminated so that you can easily tune in the channels, even in the dark, without bending over.

Built-in room lighting makes viewing more comfortable on this Sylvania. The light comes from a glowing frame surrounding the screen. On some models the intensity of the Halolight can be adjusted to suit room conditions.

Automatic selector tunes from one channel to the next when you touch the lever bar lightly. It is located on top of the Philco for no-stoop operation. A similar control in the other corner turns the set on.

Inexpensive remote control turns TV sets on or off and tunes to the channel you want. An adaptation of a military electronic device, it is made by Hallicrafters for that company's 17-incher (above), but fits most makes. Tun-O-Magic sells for about $20.

Controls on top of the cabinet instead of underneath the picture screen add convenience to many of the 1956 TVs, such as Westinghouse's 21-inch Capistrano (above).. Set has circuits mounted on horizontal boards for cooler operation, easier servicing.

PAY TV?

Here's what the fight's about . . . And here's YOUR chance to tell Washington where you stand!

SEVEN men in Washington are about to make a remarkable decision: whether it's best for you to have (or not to have) pay TV.

These seven members of the Federal Communications Commission will decide for you whether you can pay at home to see special shows, sports events and study programs on your TV screen.

If enough citizens speak up on the subject, FCC *must* listen. So here's a chance to read what the fight's all about —and decide for yourself. Cast the ballot on page 145 and POPULAR SCIENCE MONTHLY's editors will see that your views, with those of other readers, are brought directly to the attention of the men who will make the decision.

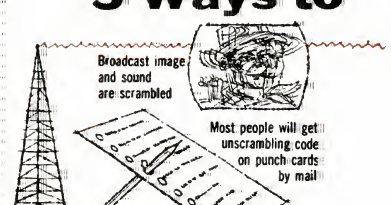
Pay TV, as you probably know, is broadcasting that looks like an egg being scrambled—until you turn on an "unscrambler" and pay what the man says.

In the "for it" corner are the fathers of pay TV: Zenith, Skiatron, Telemeter Corp., and various drama and sports producers who foresee heavy sales for their shows. The stakes—a share in a possible $3.5 billion annual take.

In the "against it" corner are broadcasters like CBS, NBC and ABC. They predict that toll TV would end the now endless free shows that you can see. They'd like to protect the nearly $1 billion sponsors pay them. Theater owners, joining them, fear loss of business.

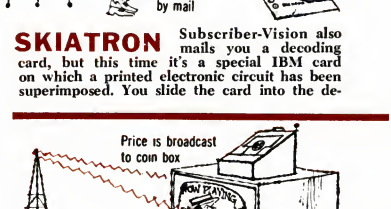
You're in the middle. You may get better shows—at an added cost to you averaging $2 a week, or some $100 a year. To protect yourself, turn the page, read the arguments—and vote.

3 Ways to



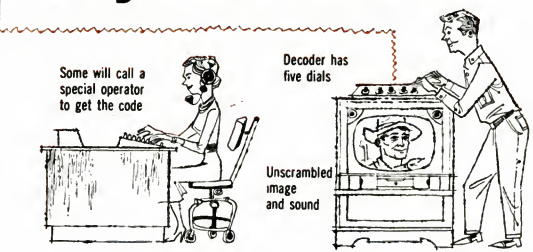
ZENITH Phonevision mails you a card with a program schedule. If you want to see a particular show you punch a hole where it's listed on the card, which then reveals to you a combination of

SKIATRON Subscriber-Vision also mails you a decoding card, but this time it's a special IBM card on which a printed electronic circuit has been superimposed. You slide the card into the de-



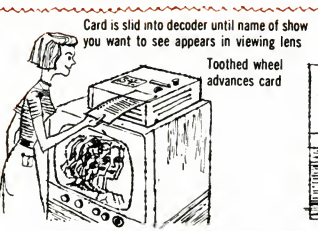
TELEMETER This system has a surprise for you: two pictures on one channel. This technical trick has become possible through a process known as multiplexing or "frequency interleav-

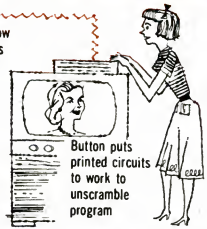
Pay-As-You-See

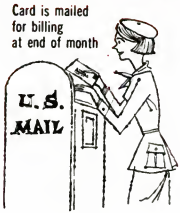


code numbers. The decoding box you've rented from the company has five knobs; each knob turns to seven positions. You set the knobs according to the code numbers, and your program's unscrambled for in-focus TV viewing.

At the end of the month you send the card to the company, and are charged according to the holes punched, which represent shows seen. Then you get a new card with the new program schedule, and start punching again.

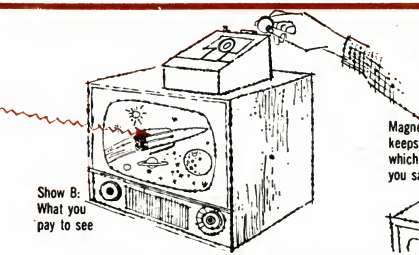


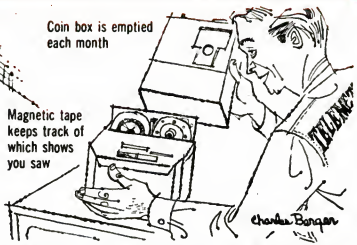




coding box and press the button. Two things happen. The IBM card unscrambles the picture by making and breaking a special pattern of connections, and a hole is punched in the card, to indicate that you've seen the show.

You will probably have to pay a minimum fee plus an installation charge for the decoder box. The number of holes punched in your card determines what else you have to pay for the programs you have watched during the month.





ing." Electronic impulses of program A (whose quality may be somewhat inferior) are sandwiched in with those of program B. Tune in your channel and you'll first see program A, which really is a kind of ad (dubbed the "marquee") telling you what program B has in store for you and what it will cost. If you drop money into the decoder box, the marquee bows out and you're in on program B. At the end of the month someone will call for the money.

Turn the page, please, for more about Pay TV

PRO's and CON's of

YOU have undoubtedly heard many of the arguments of both proponents and opponents of pay-as-you-see TV. Here they are summarized, and arranged in debate form so you can better evaluate them.

When you have read them through, and made up your mind which position is to your advantage, fill out the ballot on the next page, clip out, and mail to the editors of POPULAR SCIENCE MONTHLY.

PRO Toll TV will give you better programs—shows that are too expensive for a commercial sponsor. It costs Hollywood close to a million dollars to make a movie. The highest-priced TV performance you can see now costs just about $350,000. Clearly, first-rate modern movies are beyond a sponsor's reach.

CON The most expensive show may not always be the best show. As for movies, TV and Hollywood have recently collaborated on a number of successful projects. There are more and better movies on TV now than ever before. There would be still more if some producers were not holding out for higher prices from toll TV.

PRO To ask you to pay for a program or a decoding box is no different from asking you to buy a TV set.

CON More than 30 million people have bought receivers under the assumption they would pay nothing more for TV.

PRO Toll TV will bring you first-rate sports events—title bouts you have been unable to see on your screen for years because movie theaters have outbid sponsors and have shown the events on closed circuits. Many baseball and football events would be shown, and minor clubs would get a needed shot in the arm.

CON There are not many title bouts in a year. You can now see the World Series and the Army-Navy and Bowl games on your TV set free.

PRO Toll TV will send you first-rate Broadway plays.

CON Where will all the good plays come from? Mere money can't increase the number. A well-known critic says, "TV has had more worthwhile dramatic material on it than Broadway has."

PRO Toll TV will provide cultural programs appealing to small minorities: symphony concerts, ballet, educational features. It wouldn't be worth a commercial sponsor's while to cater to a small group of, say 100,000 people. But 100,000 viewers paying 50 cents each could breathe new life into a symphony orchestra or a college.

CON Establishing a toll TV system in a large city costs many millions; the investment for the entire country might be billions. Toll TV station operators would try to recover this investment by playing to the largest possible audiences.

PRO Toll TV will supplement free TV, not take its place. There is probably a limit to what you will be willing to pay in a week for special programs. No one will pay to see a show similar to one he can see free, so toll TV programs will have to be different.

CON Toll TV will threaten and possibly kill free TV. It will siphon off what's good in TV now—the best actors, writers and producers. Thus, if toll TV is authorized, free programs will deteriorate and more viewers will turn to toll TV. This means that a sponsor's sales message will reach fewer people; spon-

Toll TV

sors will spend less and the quality of free TV will further deteriorate.

If there is only one good TV channel in a community (which is true of many communities) the choice will no longer be "fee or free" but "fee or nothing."

PRO Free programs will improve because of toll TV's competition.

CON People who want toll TV expect programs that cost more than sponsors can now afford to pay. If sponsors can't buy such shows now, how can they when toll TV reduces their audiences?

PRO Quite a few TV stations have folded. Toll TV will stimulate interest, and new stations will open.

CON Most of these stations were in areas where not enough people bought sets. These same people cannot be expected to buy sets and pay tolls, too.

PRO Looking at TV without commercials will be worth the price of admission.

CON Toll TV advocates have not promised not to carry commercials.

PRO Toll TV will give employment to many actors and technicians as more Broadway plays become available.

CON Many stagehands will lose jobs. They will be employed, not for hundreds of evenings, but for single performances.

PRO It would be fair to give toll TV a chance, at least, to prove itself.

CON This sounds fair but isn't. Many actors would switch to toll TV immediately; many expensive shows would be bought by toll TV immediately; and free TV would start deteriorating.

Do You Want to Have Pay TV?

Now that you've read the arguments, fill in the ballot below.

I am . . .

☐ **For Pay TV** ☐ **Against it**

☐ **Can't decide, but think it should be given a trial.**

Of the three systems suggested,

☐ **I prefer Phonevision**

☐ **I prefer Subscriber-Vision**

☐ **I prefer Telemeter**

☐ **I have no preference**

In the blanks below indicate what kind of show you'd be willing to pay for, and how much.

Good movies
I'd pay up to ..... per program.

Top sports events
I'd pay up to ..... per program.

Broadway plays
I'd pay up to ..... per program.

Travel features
I'd pay up to ..... per program.

Science features
I'd pay up to ..... per program.

Medical features
I'd pay up to ..... per program.

Home classroom features
I'd pay up to ..... per program.

Hunting and fishing
I'd pay up to ..... per program.

Your Name:_____

_____ Age:____

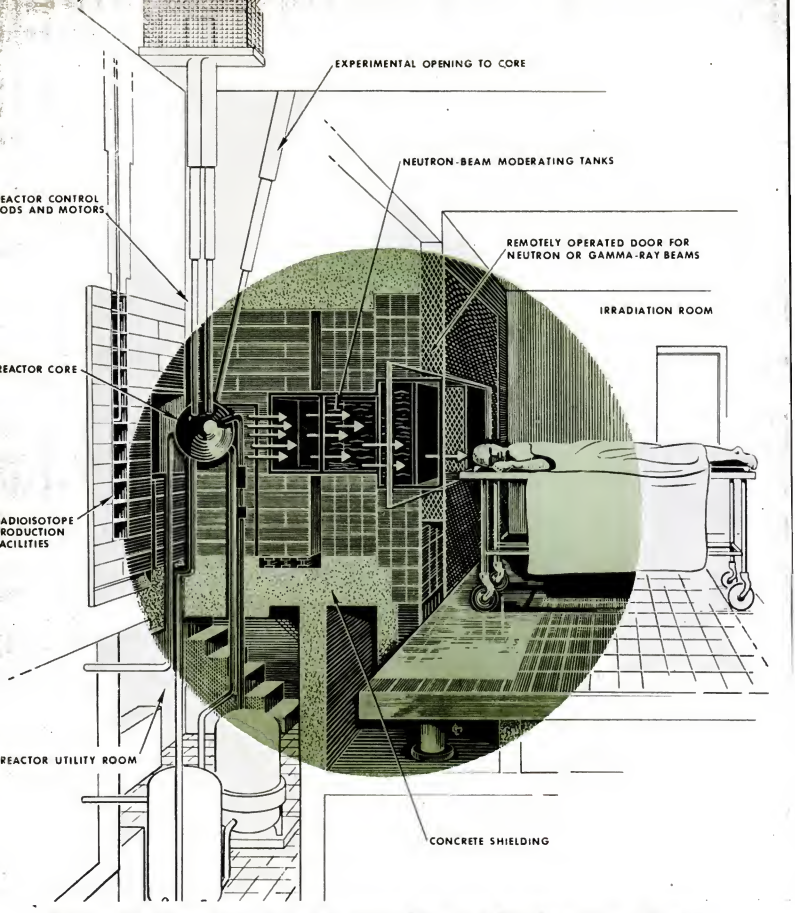
Address:_____

_____

Now, clip out this ballot and mail it, by Nov. 1, 1955, to:

TV Editor, Popular Science Monthly, 353 Fourth Ave., New York 10, N. Y.

Your views will be called to the attention of the Federal Communications Commission, and you'll find the results of the survey in a future issue of POPULAR SCIENCE MONTHLY.



Atomic Reactor to Be the First All-Medical One

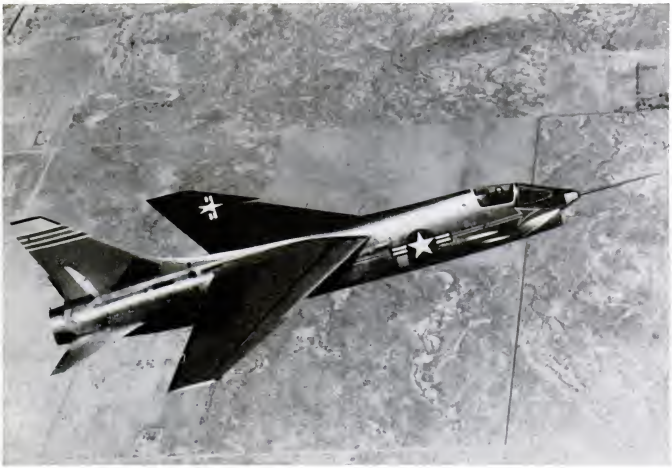
CALLED the first nuclear reactor designed especially for medical use, the one above will begin treating cancer patients about 1957, at the University of California at Los Angeles. From a sphere holding a uranium 235 solution, neutrons and gamma rays will stream through a window upon a patient as shown in the drawing above. To confine stray radiation, a complete hospital including the reactor, treatment room, labs and offices will be underground.

Atomic hospitals until now have used general-purpose reactors—as at Brookhaven National Laboratory, which pioneered in neutron therapy. An all-medical reactor will provide a more ideal operating room.

"Blastproof" Building Sets Atomic-Age Style

WILL cities take on the appearance of medieval fortresses, for defense against atomic assault? Here may be a preview of the architecture of tomorrow's metropolis—the new Armed Forces pathological building, called the first nuclear-blast-resistant one in the nation's capital.

Three of its eight stories lie underground. Above the surface rise windowless walls of steel-reinforced concrete, designed to yield to a blast wave without breaking. Narrowest side faces the center of Washington, likeliest bomb target. Within, ultra-modern laboratories speed diagnosis for patients in nearby Walter Reed Army Hospital.



New Carrier Jet Cuts Through the Sky Like a Supersonic Arrow

Our newest dayfighter—the XF8U-1 above—can blast its way to a target at more than 700 m.p.h. A Chance Vought jet for flattop duty, it wraps its powerful turbojet in a pound-saving airframe built largely of titanium. The short, pointed nose and small cockpit cut drag and aid the over-the-nose visibility desirable for carrier landings.

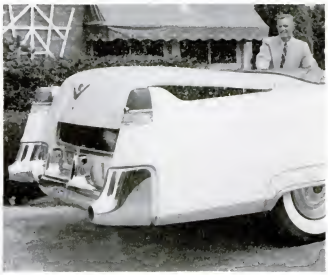
Giant Pie Cooked Up by Frenchman Is Latest Flying Saucer

René Couzinet of Paris is making a bid for the flying saucer trade with this circular craft. A huge metal pie almost 27 feet in diameter, it will be powered by three 135-hp. engines. The engines will spin the upper and lower disks in opposite directions and whirl the craft on its way, says Couzinet. To keep pilot and passengers from being spun dizzy, the cockpit under the bubble canopy is set in a fixed center section. Couzinet hopes to get his Aerodyne off the ground some time next year.

Water Bombs Douse Forest Fires

In Ontario, forest rangers are using water bombs to wet down dry brush and slow the spread of flames until ground crews arrive. The technique is similar to Uncle Sam's "Operation Firestop" (PSM, Aug. '55, p. 100), except that the Canadians drop ordinary paper bags filled with water. They're launched from bomb racks beneath the copter (above) or placed on conveyors to be dumped through a camera hatch. Bombing runs are made only 200 feet above treetop level at about 80 miles an hour.

▶▶▶One out of 12 acres under cultivation in the U.S. gets aerial treatment, according to the CAA. Since the first plane was fitted up to do a job on fruit trees back in 1919, spraying, dusting and fertilizing from the air has been extended to more than 200 different crops.



Car Flips Its Lid Automatically

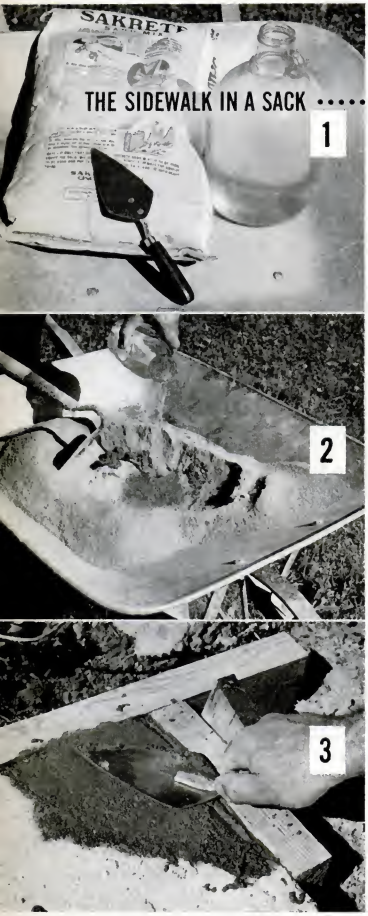
The trunk on this Caddy was opened by pushing a button in the glove compartment. A motor now available as a factory-installed extra unlocks the lid and lets it swing up part way for easy lifting. A red dash light tells when the trunk is unlocked.

Milady's Heels Are of Wire

Now the gals will be walking on air—almost. Last summer's shoes with high heels of transparent plastic are giving way to skeleton heels of wire. These, designed by Bally of Switzerland, were seen at a London showing of fall and winter styles.

He Built His

Art Avril invented "cake mix" for home handy men: add water, stir—and be your own mason.



By George Laycock

ART AVRIL was broke, back in the Thirties, when he got the idea that concrete could be mixed dry and sold to do-it-yourselfers like cake mix: to use, just add water and stir. Now 21 plants from Ohio to Australia are producing his Sakrete, and 30,000 stores sell 15 million bags a year at an average price of $1.25 per bag.

When Avril was graduated from Ohio State University with a degree in mining engineering, trucks hauling ready-mix concrete were a rarity on the highways. He saw a future for such a business in Cincinnati, his home town. The ready-mix plant he built there was one of the first in the country and it prospered in its early years.

Then the depression caught up with Arthur C. Avril. Construction work fell off sharply and he went broke. But while his first business was still on its death bed, Avril began searching for an idea on which to found a new one.

It was then that he recalled how homeowners had come to his plant with buckets, scooped up the drippings, and carried them home to use on jobs too small to justify mixing a whole batch of concrete. Why not, Avril wondered, tap this market by mixing up the dry materials for concrete and selling them in bags ready for home use?

He began experimenting with the idea in his basement during spare hours. Avril knew that it's not easy for amateur masons to make good concrete time after time. He thought, however, that he could

Fortune on a Concrete Foundation

Avril proudly surveys Cincinnati plant where Sakrete is automatically mixed, dried, bagged.

make it easy and foolproof for anybody.

To measure out and shovel the raw materials—sand, gravel and cement—into a bag just as they come from freight cars would never work, he knew. The sand and gravel carry enough moisture to hydrolyze the cement and cake the mixture hard in its bag.

In his basement Avril built a small-scale model of a drying device. The materials tumbled around in a metal drum that revolved over an open flame. By experimenting he learned how to remove all the surface moisture and up to 80 percent of the internal moisture in concrete aggregates. And he did it without the overheating that would have caused product-weakening chemical reactions. He also tried various mixtures, to get the right proportions of sand, gravel and cement.

"I started with what I knew was good concrete," says Avril, "and figured out how to improve it." Instead of concrete

that would meet just the normal specifications of 2,500 pounds' pressure per square inch for foundation work. Avril designed one that tested 4,000 pounds or better. The extra cement provided a safety factor and made the mix easier to work.

Variety of mixes. Avril came up with three basic mixtures that would take care of any small job around the house, factory or farm. He made a sand mix for brick work, a mortar mix for finishing basement walls or cisterns or resurfacing old concrete work, and a concrete mix for all manner of heavier projects.

Once he had worked out his basic formulas, Avril faced production problems. In typically direct manner, he designed the production machinery himself and arranged to have it built.

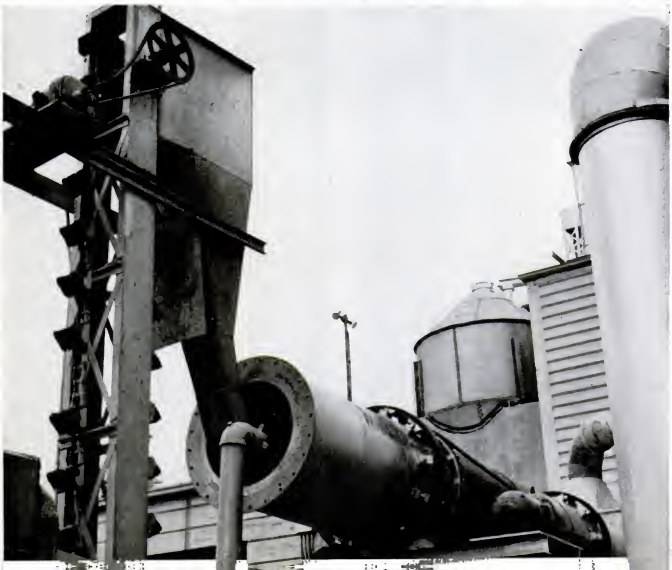
He decided on a 90-pound bag for his concrete formula. This much mix calls for an even gallon of water. It also gives an easily measured yield: four square feet of concrete two inches thick, or two square feet four inches thick. Avril credits these early calculations for the fact that, in 18 years of marketing his product, he has had fewer than a dozen complaints.

For smaller jobs, Avril puts out a half-sized 45-pound bag. He even began marketing an 11-pound bag for patchwork jobs. Why 11 pounds? "Because it's roughly one-eighth of 90," says Avril, "and it takes about a pint of water."

Production first got under way when, for $35 a month, Avril rented a small, yellow, frame building in the flood-plagued Ohio River bottoms. Into this he moved the drying, weighing and bagging equipment he had bought on credit. Busy Art and Mary Avril dropped out of their social circle, no longer had time for parties. "We hibernated for 10 years," says Avril.

In the beginning they were the whole crew at the plant. During their first year they produced 36,000 bags of Sakrete and a few years later the two of them

DRYING OF MATERIALS is the key to Avril's ready-to-mix concrete. Gas-burning flame in the setup below dries out wet sand in a revolving drum. Hot sand, in turn, dries gravel.



A RUBBER CONVEYOR BELT runs in a tunnel beneath the outside materials bins. Here a hopper drops its load for a ride to a dryer unit. Machinery was designed by Avril himself.

AT END OF PRODUCTION LINE, bags of freshly made concrete-mix are machine-sewn and then stacked on a truck. A new stacking device soon will make even this last step automatic.

were turning out 140,000 bags per year!

Mary kept books and ran the office part of the time. But a good share of her day was spent bagging concrete or driving the truck.

In those early years, when the two Avrils together took out of the business only $15 a week, there was little money for advertising. But their first customer did more to publicize Sakrete than either of them realized at the time. The Cincinnati Gas and Electric Company said it needed a $250 deposit from Avril before he could throw the starting switch on his machinery.

In lieu of the $250, Avril, after some fast talking, promised to deposit 500 bags of Sakrete with the company.

When they were delivered, the company's maintenance foreman wouldn't touch the stuff. A month later the warehouse foreman, a friend of Avril's, happened to run out of raw materials for concrete.

Grudgingly the field crew took several bags of Sakrete along. By noontime they'd done a usual day's work and were back for seconds. Word of the new concrete mix soon spread around among other firms after that. (Today this same company buys about 15,000 bags of Sakrete a year from Avril.)

Flood washes business away. The Avrils had been in business about a year when the Ohio River went wild in the flood of '37. Its crest swept through their little yellow factory building, ruining the expensive machinery. The machinery had to be rebuilt and Avril picked out a new site for a factory—this time well out of the river's reach.

Bids on building the new factory staggered Avril. Then he recalled a type of concrete construction he had once worked out for use in coal mines: pour solid concrete walls between steel forms, let it set, move the forms, and pour another section. He used the steel forms for his new plant and built it for half the contractors' quotations.

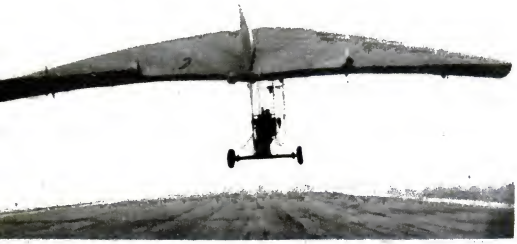
The idea worked so neatly, in fact, that Avril later built himself a nine-room house with the same forms. Today he's toying with the idea of building concrete shells for new homeowners who want to finish their own houses. During the winter, when home use of Sakrete slacks off, he spends much of his time working out ideas like this and designing new plant machinery.

Licensing spread distribution. As orders for Sakrete began coming in from places farther and farther away from Cincinnati, Avril discovered that freight charges were eating up much of the profits. His solution was to license local companies around the country to build and operate other factories like his own. From these plants Sakrete is distributed in 44 states. There's also a plant in Canada and three planned for Australia.

"We've come a long way since we stepped out of that basement," Avril says with a smile. END

Rocket Plane Is Readied for Flight into the Heat Barrier

READY for power flight, this Bell X-2 is the first plane ever designed to probe the heat barrier—the speed where friction heat makes a plane inoperable. Engineers expect the rocket-powered X-2 to better the present record of 1,650 m.p.h. The cabin is detachable—in an emergency, the entire compartment could parachute to the ground.

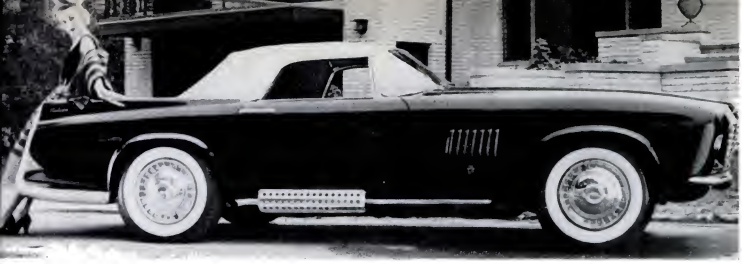


Huff and a Puff Inflate Plane

AN ORDINARY tire pump inflates the wings of this British plane. It's the M. L. Utility Aircraft, shown from rear taking off (top) and (below) from the side.

A wingspread of 40 feet lifts the 550-pound plane and two passengers. Wings are inflated before flight, deflated after for easy storage or transport. A 65-hp. engine gives the craft a range of about 100 miles.

The British Ministry of Supply has placed an order for several of the planes, which are said to be easy to produce and relatively inexpensive.



The Roadster Is Back—at least a version of it. The fancy-pants automobile above is one of three "idea" cars being exhibited by the Chrysler Corp. Called the Falcon, it's a roadster only 51 inches high. It's priceless. There's only one of it in existence.

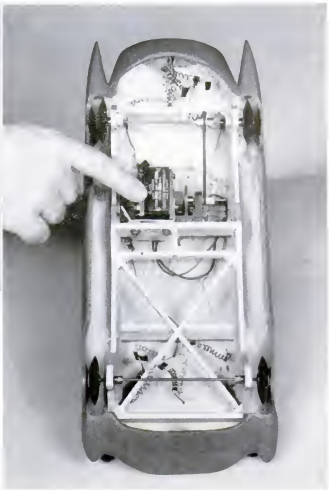
Chrysler Shows New 'Idea' Cars

Counterbalanced Deck Lid in two parts holds spare tire of Flight Sweep II. Tire nests in lower part. There are no seams or joints in the four-passenger hardtop; front fenders, cowl and body are welded to frame. All three cars have upswept tail fins.

Sports-Type Grille adorns Flight Sweep I, a four-passenger convertible only 53½ inches high. Bumpers are "integrated," and turn indicators are snugged under the headlights to unify the front end. The windshield slopes sharply and dramatically at 56 degrees.

Rocket Blazes a Fiery Trail in First Nighttime Photo

A ROCKET traveling at 2,000 m.p.h. flashed into the night. A photographer clicked his shutter. Result: the first night photograph ever made of an in-flight jet firing its rockets. The picture of the F86-D interceptor was taken near Selfridge Air Force Base, Detroit, by means of flash bulbs mounted on a second jet's wing-tip tanks.



Sun's Light Powers Tiny Car

SUNLIGHT runs this 15-inch Sunmobile built by GM researchers. Rays striking 12 selenium photocells atop the car (above) generate electricity to run a 1½-volt motor (right) and spin the rear wheels.

Is the Sunmobile a forerunner of full-size sun-powered cars? No, says GM. Even 100-percent-efficient cells could produce only 12 hp. for the average car.

FOOD MIXER

DISHWASHER

VACUUM CLEANER

LAWN MOWER

REFRIGERATOR

WASHER

OIL BURNER

Those Little Motors Everybody Uses

By Gardner Soule

PEOPLE laughed when, back in 1889, a young inventor named Nikola Tesla came right out and said that electric power would one day be used like water in American homes.

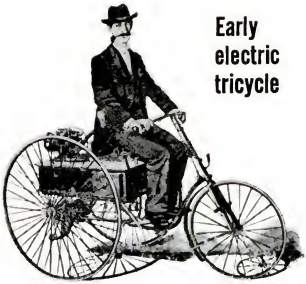
Everybody knew that electricity cost so much that only streetcar lines and other big companies could afford it. Besides, Tesla was prejudiced. He and George Westinghouse, founder of the Westinghouse Electric Corp., then a small, struggling company, were trying to sell a funny new gimmick: A three-bladed steel fan that you were supposed to hook up to your electric light line—if you had one.

That fan—powered by a 1/6-hp. motor—was the first appliance driven by a fractional-hp. electric motor ever offered to the U.S. public.

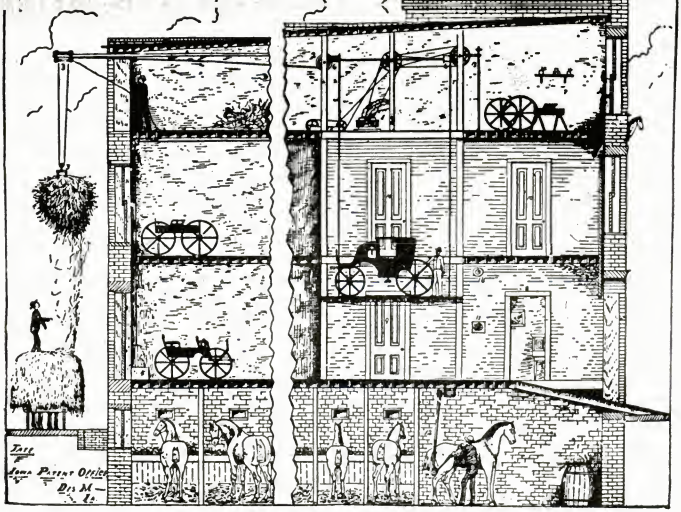
By 1955, with electricity used as Tesla said it would be, and Westinghouse doing very well indeed, the descendants of that fan are so numerous that nobody knows how many fractional-hp. motors there are at work in U.S. homes, farms, offices and factories. Reasonably informed guesses run around 400,000,000. If all were to be turned on at once, the nation's generating facilities would break down.

Actually, there are far more motors than people in the nation's homes. General Electric figures that the average family uses six. These most often are in a fan, vacuum cleaner, refrigerator, food mixer, washing machine, and perhaps a portable electric drill. But families almost as frequently possess an ironer, electric pump, furnace blower, record player, electric lawn mower, some home-workshop power

Early electric tricycle



1870's: Marmaduke M. M. Slattery appeared on a battery-driven tricycle. All kinds of electric vehicles helped engineers develop fhp's.



1880's: Early use of small motors—in horse-and-buggy age—was to take care of horses and buggies. Electric motors hoisted hay (left), ran elevator (center), groomed horse (lower right). Frank J. Sprague, a great U. S. electrical inventor, promoted a stable like this in Des Moines, Iowa.

tools, an air conditioner, a clothes dryer, or a food freezer.

A fractional horsepower may be what engineers call "one fleapower" (as in a clock) to one horsepower (in some air conditioners). Most now manufactured are 1/6, ¼, ⅓ or ½ hp. It may weigh a few ounces (in a shaver) to 25 pounds (in a washer). Westinghouse alone makes around 4,500 kinds.

Instead of one company peddling a single fan, there are, in 1955, about 95 manufacturers of fhp's. Some put the midget motors into finished products; some sell them to 4,340 other U.S. manufacturers who do so. Total production in 1955: 44,000,000 motors.

By far the greatest use of fhp's is in the kitchen, where the homemaker today is likely to have her work much more mechanized than her husband's.

The second greatest use of fhp's is where you may not have suspected: in offices, running typewriters, adding machines, ice-water dispensers, calculators and dictating machines. A brand-new check writer is driven by two Westinghouse fractional hp's. In New York recently, M. Lowenstein & Sons, a textile firm, opened new offices and happily displayed a conveyor belt, powered by fhp's, that transports papers to any of their offices on six floors, and a fhp-powered system that answers the long-distance phone and takes down orders from salesmen anywhere.

The third most widespread use of the little motors, as

any reader of PSM will know, is power tools for the home workshop.

Next? GE predicts that fhp's soon will draw the living-room drapes, fold attic stairs into the ceiling, move a retractable roof out over your terrace in case of rain. In a business that has multiplied 40-fold in 30 years because of new uses for its products, these dreams are no great leap from today's beds, cradles and rocking chairs that lull you or your infant to sleep; kitchen shelves that move up and down when a button is pushed; garage doors that open when you toot your horn; an outdoor barbecue that turns its own spit; an aquarium for tropical fish that ventilates itself with air bubbles; and a vibrating toothbrush—all driven by fhp's.

This fan started it all

1889: First household appliance powered by fhp motor was this Westinghouse fan. Back of it was Nikola Tesla, an immigrant from Serbia, who developed (1) alternating current to replace DC; (2) suitable AC motors.

After Tesla's fan the biggest break for fhp's was the electric refrigerator, powered by a hermetically sealed electric motor. A French monk named Audiffren had the idea back in 1901. GE wrestled with it from 1910. By 1920, its engineers had sealed the motor, compressor, condenser and evaporator all in one shell in an oil bath.

While doing so, GE had accomplished several things: The size of the motor had been reduced. The belt drive of the first electric refrigerators was eliminated. A large part of the noise was gone. Swimming in a bath of oil eliminated re-lubrication and servicing, and the permanent seal ended the dirty job of cleaning the floor beneath the refrigerator where oil drippings of earlier motors had collected dust.

Reductions in motor size, in turn, made possible the host of power tools today. Reductions in noise pleased everybody. Above all, a motor that never needed any attention—not even oiling—had tremendous appeal to housewives. Fhp's were on their way.

Motors have grown smaller. Weight of ¼-hp. has been reduced from 69 lb. (left, about 1903) to 16 (1955 model, below)—about a pound a year.

World War II, remembered by many people perhaps as most notable for atomic power, was to millions of GI's, sailors, airmen and engineers, the small-motor war. Fhp's pushed the power controls in tanks, Flying Fortresses, LST's and PT boats.

Out of the war, fhp's emerged with two enormously significant improvements:

- *Better steel alloys,* from which the small motors are made. The new alloys have 20 times the magnetic properties of

chrome steel. This is of the utmost importance. An electric motor essentially consists of a spinning magnet—the armature—inside more magnetized steel—the stator. Electricity, flowing into the motor, magnetizes both the armature and the stator, and alternate attraction and repulsion spin the armature. The armature, in turn, revolves a shaft that moves something, like a fan blade.

• *Better insulation.* Military requirements sped development of new enamels, as much as one-third more heat-resistant than older insulation. The new enamels mean that fhp's can run hotter and deliver more power and can therefore be smaller for the work they do.

There have been a host of other improvements during the war, and since: Industrial designers have been called in to streamline the appearance of motors (or at least those that show). The fhp's have been developed for all climates, Arctic to equator. Some today have automatic shutoffs in case they overheat.

Many fhp's now operate in any position while lubricating themselves satisfactorily. They no longer cause excessive light flicker on starting. Parts are fewer, simpler, standardized.

They last. "Forever and ever," says Walter A. La Pierre, assistant professor of electrical engineering at Columbia University. Maintenance is almost zero. "I find," says Dr. La Pierre, "that the best way to take care of an fhp is to leave it alone."

They rarely fail. Frank Trembath, of Syracuse, N.Y., who sells a vast number of fhp's a year for Westinghouse, says: "We allow one percent of our net sales to take care of motors that fail within two years of manufacture. This is usually more than sufficient." Most failures, he says, are spotted before the fhp's leave Westinghouse. Then, Westinghouse simply scraps them. With automation the manufacturing cost is so low ($10 for a washing-machine motor), it doesn't pay to make even simple repairs.

Just as people had laughed at Tesla, who developed the fhp motor, they laughed at the motor's original inventor.

He was Thomas Davenport. Born in 1802, Davenport was the blacksmith at Brandon, Vt. Weighing only 140 pounds, he had to tote anvils and weild heavy hammers on horseshoes. In 1833,

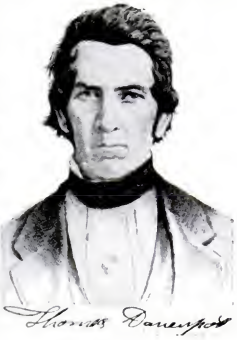
[Continued on page 252]

1955: Motors are produced by the million in streamlined factories. Engineers have devised ingenious ways to test and improve performance:

Smoke test shows how fhp is ventilated.

Fan motor is hung on string to test noise.

New explosion-proof motor, when submerged in gasoline, pumps gas safely.



New Ideas

FROM THE INVENTORS

1 Hardtop to Convert. The strength and safety of a closed sedan would be combined with the style and comfort of a convertible, the inventor claims, if a car had this sectioned metal top. Levers telescope the panels into a space in the rear deck. With the top up, flanges lock the panels to each other and to body-frame uprights.

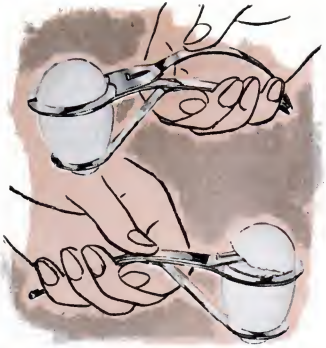
2 Ladder Arm to Hold Paint Can. A bracket like this slipped over the side of a ladder would put a paint bucket where you want it. It could be set at any point on the ladder. The paint can, suspended from one of the notches in the arm, would level itself and lock the clamp to the ladder.

3 Sleeve Wallet to Foil Thieves. It would take a pretty slick pickpocket to make off with a wallet that was snap-fastened inside your sleeve. You'd stitch a separate snap-fastener stud to each of your jackets, slip this wallet into the top of your sleeve, and lock the flap in place.

Please turn the page for more new ideas

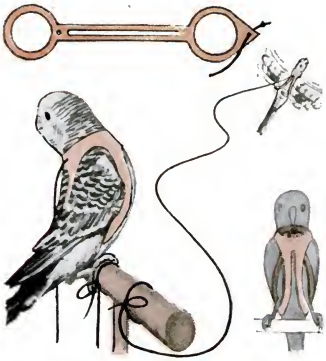
MORE New Ideas from the Inventors

4 Hanger to Put Pants First. Makers of ordinary clothes hangers ignore the simple and obvious fact that you always remove your jacket before your trousers. This hanger would set things to rights by putting the trouser bar in front of the coat supporter. It would make it easier for you to drape your garments on yourself or on the hanger in proper sequence without wrinkling.



5 Egg Holder to Slice Shell. It's often easier to boil an egg than to eat one, but with this device you could enjoy your breakfast while it's hot. You'd grip the egg in the holder to lift it out of the water, then push the notched blade forward and down to sever and flip off the end. The inventor says the clean cut would keep shell fragments from falling into the part you eat.

7 Fireplace to Need No Chimney. Even when it's possible to install a fireplace in a house or apartment that doesn't have one, the cost of chimney construction usually puts it out of reach. This chimneyless log burner, however, could be installed—or moved—at any time. Smoke from the fire chamber would travel through a series of baffles. Electric blowers would then draw it through replaceable filter packs. The inventors say the baffles would remove soot and fly ash while the filters would screen out smoke and gases, so only clean, warm air would be vented to the room.



6 Harness to Tame Pet Birds. You could give a parakeet or canary the run of this leash and not worry about its flying away or zooming into the next room to wake the baby. The sleeveless jacket would let the bird move its wings and legs. However the harness wouldn't hurt or strangle the bird even if it flew to the end of the string and were brought up short.

8 Motor to Rock Crib. New babies—and their parents—might get a little more rest with this electric crib rocker. It would attach to and under one leg and impart a combined rotary and reciprocating motion. Stops fitted to the other casters would keep the crib from walking away.

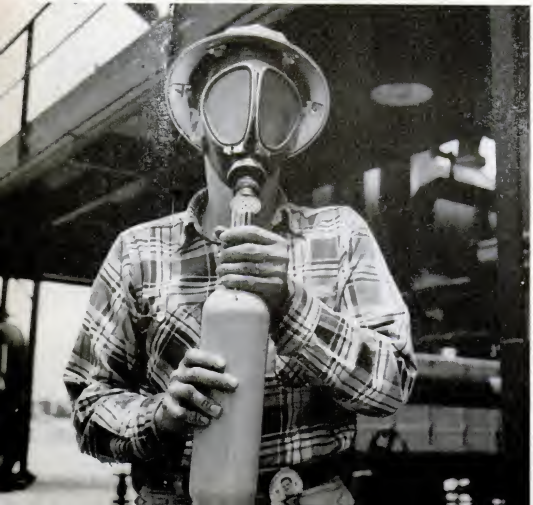
9 Raised Light to Signal Stops. There might be fewer pile-ups if signals of a lead car weren't hidden by the car behind. This antenna-mounted brake light would warn drivers farther back in line.

U.S. patents on these inventions have been granted to: 1. H. Anschuetz, Plymouth, and L. Serratone, Walled Lake, Mich.; 2. R. Keller, Tacoma; 3. L. Fulton, Seattle; 4. R. Waldman, Jersey City; 5. P. Jepson, Oakland, Calif.; 6. E. Cooke, Memphis; 7. L. Fogel, Levittown, N.Y., and 4. Fogel, NYC; 8. R. De Frank, Vineland, N.J.; 9. J. Sweet, Chicago.

Tepee "Tower" Brings TV To Indian Chief

CHIEF White Eagle of the Iroquois Tribe at Caughnawaga, Que., could get Montreal stations on his 20-inch television set with an inside-the-wigwam antenna. But to receive Vermont and New York telecasts he needed an outside aerial. So naturally he installed it atop his genuine, hand-built, birch-bark tepee. This boosts the antenna 40 feet.

The Chief's legal name is Stanley Myiow and he makes his wampum as a skilled bridge worker. Both Chief and TV live, not in the tepee, but in the very un-Indian clapboard bungalow behind. Only the antenna's on the tepee.



No-Strap Mask Gives Air Fast In Emergencies

A NEW emergency mask lets refinery men rescue themselves when things go wrong. Automatic valves supply air at the first indrawn breath, and there are no straps to delay getting it on—it's just held over the face. The tank holds four minutes' worth of air, enough for a quarter-mile walk out of danger. Evan O'Relly, safety engineer with Standard Oil of California developed it.

Race a train or punch a cop—this driver appears drunk and frisky enough to chance it.

New Machines Get Drunks Off the Road

Cops now use mechanical noses to measure how much alcohol a tippling driver has consumed.

By Joseph Dorlaque

INDIANAPOLIS police arrested a trucker who had lost control of his pickup on a busy boulevard. Crashing into a filling station, the truck had pinned a boy against a gas pump and broken his leg.

Angry witnesses testified that the driver had staggered out of his cab, reeking of alcohol and mumbling with thick and uncontrolled tongue.

"Throw the book at that wino," a bystander snarled as the cops took him away for investigation.

The trucker claimed he had had only

These are the machines that convict a drunk driver

PORTABLE BREATHALYZER, newest of the lot, can operate off a car battery. A balancing act by two photocells swings the needle to show accurately how much alcohol is in the breath.

OLD RELIABLE DRUNKOMETER depends on a purple chemical which fades when balloon-stored breath of drunk driver hits it. Gasometer, right, gives a rough measure of alcohol in the blood.

two beers and insisted he couldn't have avoided the accident. So the police had him blow through a tube into a black metal box a little larger than an electric toaster. Two minutes later a dial on the box showed that his blood contained .03 percent alcohol—too little to make the average person drunk.

Hospital examination revealed that the driver had been hurt. A mild brain concussion had made him appear drunk. The police investigation soon established that actually he could not have avoided the accident. He had swerved into the filling station to avoid a school bus. The truck driver was released.

But for the breath-testing instrument that eliminated guesswork by the police and witnesses, this unlucky driver, his breath smelling from his two beers, might have gone to jail, paid a heavy fine and lost his driver's license and his job.

Thousands of drunk-driving cases, some like this, come up each month. The way they're handled is changing, however. The hunches and walk-a-straight-line methods of old-time police work are being replaced by scientific devices to tell the cops just how drunk a driver is by analyzing a whiff of his breath.

Three such instruments developed during the last 25 years already are familiar to the police and tippling drivers in nearly all the 48 states, Canada and several countries overseas. Medical and legal authorities show steadily growing respect for their superiority over human testimony.

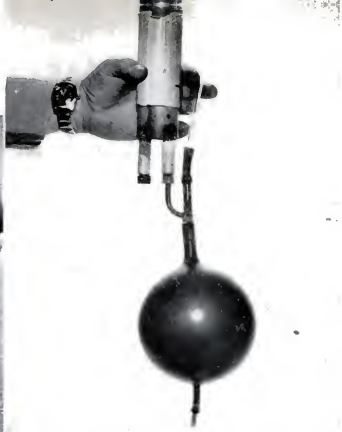
Now a fourth breath-testing device is making its debut. Called the Breathalyzer, it is the first to be developed by a police officer: Lt. Robert F. Borkenstein, director of Indiana State Police Laboratories. It can be used anywhere, it works fast and accurately, and it can be operated by anyone. Toronto University scientists who tried it for four months called it "the best ever tested."

The Breathalyzer can finger a drunken driver—or clear a sober one—as soon as the police stop him. It will work right at the side of the road. It's as portable as a Thermos jug and operates from a car battery as readily as from ordinary house current.

Suppose *you* were tagged by the cops. They would ask you to blow into a rubber tube until you were completely out of breath. The tube leads to a small cyl-

on a whiff of his breath

ALCOMETER'S PUSH-BUTTON OPERATION simplified breath-testing equipment. It works automatically, much like the Breathalyzer. A verdict shows up on its meter in a matter of minutes.



INTOXIMETER, IN 39 SECONDS, gives a rough idea of drunkenness when sample breath from a balloon fades the liquid in the tube at right. Other tubes collect breath for finer analysis.

inder having a simple piston valve that lets the air out as you blow it in—until your last wheeze. Then the valve shuts, trapping some 3.4 cubic inches of your "true breath" inside. This air comes from deep inside your lungs, where it has absorbed a known fraction (1/2100) of any alcohol in your blood.

Now the cop flicks a valve, sending this small sample of your true breath into an ampoule containing a yellow solution of potassium dichromate in sulfuric acid. This solution absorbs alcohol, and in doing so its color fades. The more alcohol in your breath, the paler it gets.

A photoelectric cell can measure the color change. For greater accuracy, Borkenstein uses two photocells in his Breathalyzer. One measures light coming through the test ampoule of dichromate that has been exposed to the alcohol; the other measures light coming through a sealed reference ampoule of unaffected dichromate. A knob moves the light until the two photocells balance each other. How far the light has to be moved to strike this balance tells how much alcohol there is in your blood. The cop reads it off the dial.

Much the same scheme is used in the other three drunk testers. They all reveal the amount of alcohol in your blood by measuring the amount a chemical will absorb from your breath. All are highly accurate.

The Drunkometer is the oldest and most widely used of these devices. It was invented 25 years ago by Dr. Rolla N. Harger of Indiana University.

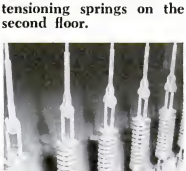
A suspect being tested blows up a balloon, and then the air is let out of the balloon to bubble through a solution of potassium permanganate. The idea is to find out how much of the breath has enough alcohol—.0000056 ounce—to bleach out the purple color of the permanganate. From this the alcoholic content of the blood can be calculated.

The Drunkometer gives a rough measure of blood alcohol directly. A more accurate analysis, however, requires a chemist's delicate balance.

The Alcometer, a big, fully automatic instrument devised by Dr. Leon Greenberg of Yale (PSM, Sept. '51, p. 124), will trap a sample of true breath just as the suspect runs out of wind, working much like the Breathalyzer. The sample

[Continued on page 270]

HARP-STRING WALLS of 14-floor parking garage give an airy view but are stronger than masonry. Cables run through holes in parapets. They're strung from the thirteenth floor to tensioning springs on the second floor.



Bird-Cage Garage Has Wire Walls

BIRD CAGES are helping to solve Chicago's parking problem. This one has 14 cantilevered floors, walls made of steel cable, and elevators that run up and down, sideways or on a slant.

Each of its five elevators serves three side-by-side lanes and four front-to-back parking stalls. Push buttons automatically switch an elevator to a selected lane. Three of the four stalls in each lane are used for parking, and the fourth is reserved for maneuvering cars in or out of their parking places.

ONE OF 10 GARAGES built or planned for Chicago's Loop, this bird cage can park up to 774 cars. Operators claim average delivery time of one minute from parking stall to exit ramp.

They Say Now .....

EZRA TAFT BENSON, SECRETARY OF AGRICULTURE: *"It takes roughly 3,000 gallons of water to grow a pound of cotton . . . 40 gallons to grow the feed to produce the egg . . . 1,800 gallons to grow the grain to make a pound of beef."*

C. G. SUITS, GE VICE-PRESIDENT AND DIRECTOR OF RESEARCH: *"A careful look at the commonplace and familiar may reveal . . . exciting gems of scientific knowledge."*

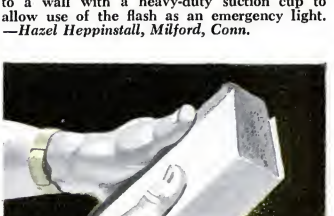
SENATOR ALEXANDER WILEY: *"Everywhere, we are running into a severe shortage of trained engineers. The Soviet Union is graduating 2½ times as many engineers as we are, each year."*

DR. WILLARD F. LIBBY, ATOMIC ENERGY COMMISSION: *"We do not have the faintest idea of what the real explanation of nuclear forces is. We have gotten to the stage of knowing in the last 20 years that we are completely ignorant; 20 years ago you could find an explanation."*

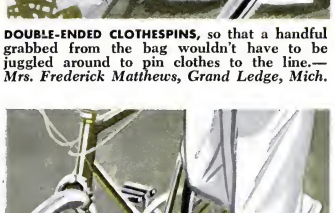
I'd Like to see them make...

A FLASHLIGHT HOLDER that you could attach to a wall with a heavy-duty suction cup to allow use of the flash as an emergency light. —*Hazel Heppinstall, Milford, Conn.*

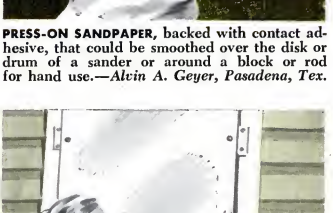
DOUBLE-ENDED CLOTHESPINS, so that a handful grabbed from the bag wouldn't have to be juggled around to pin clothes to the line.—*Mrs. Frederick Matthews, Grand Ledge, Mich.*



PRESS-ON SANDPAPER, backed with contact adhesive, that could be smoothed over the disk or drum of a sander or around a block or rod for hand use.—*Alvin A. Geyer, Pasadena, Tex.*



FOLDING PEDALS to make it easier to walk with a bike. Pull-out pins could drop them or they could be hinged to snap up when the feet are removed.—*Prem Nath Java, Delhi, India.*



HURRICANE GUARDS of solid aluminum to protect windows. Screens or storm sash could be fitted with permanent bolts so guards would go up fast.—*E. Woolner, New Bedford, Mass.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE MONTHLY readers. What is *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

New Aids to Living...

A long drink is always on tap for plants tended by Waterwick. When the table-top gardener leaves home the wick takes over the watering chore, keeping the soil moist for as long as two weeks.

Blow-up bib of plastic catches spills when a youngster starts manipulating a spoon and drinking from a glass. Fitted over the high chair tray and inflated, it keeps the tot, the chair and the floor clean. Later it can be used on a table top for finger painting, water coloring or clay modeling.

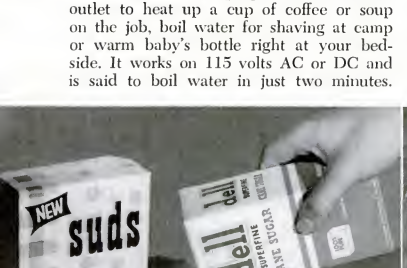
Cartridge pen is filled like a ballpoint but writes like a regular fountain pen. The nib section, which carries the pen point, is unscrewed to insert a new cartridge. When this unit is screwed back on, an ink-feed tube in its end pierces the cartridge.

One-hand strainer lets the cook drain off cooked vegetables without juggling a pot lid in hot steam. It also doubles as a colander for washing dried and raw foods. Made of aluminum, the strainer hooks tightly to any pot from six to nine inches across.

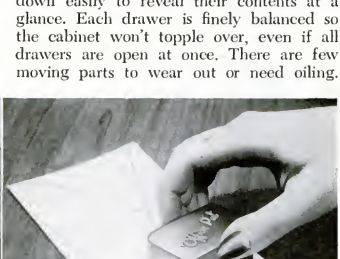
Further information on these products can be obtained from: (Wick) Waterwick, Box 66, Ridgeway Sta., Stamford, Conn.; (Bib) Bib & Tucker Co., Box 6616, W. Palm Beach, Fla.; (Pen) Sheaffer Pen Co., Ft. Madison, Iowa; (Strainer) Today's Home-

Immersion heater plugs into the nearest outlet to heat up a cup of coffee or soup on the job, boil water for shaving at camp or warm baby's bottle right at your bedside. It works on 115 volts AC or DC and is said to boil water in just two minutes.

Tip-out drawers on this filing cabinet drop down easily to reveal their contents at a glance. Each drawer is finely balanced so the cabinet won't topple over, even if all drawers are open at once. There are few moving parts to wear out or need oiling.

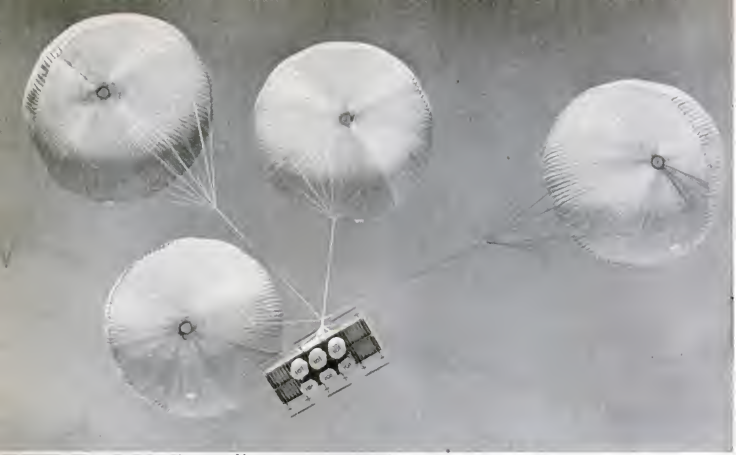


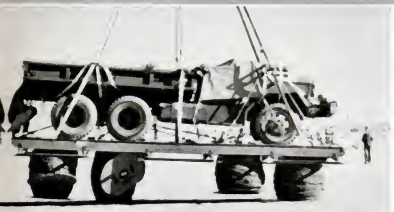
Cartons will soon measure the dry products they pour. A two-section box has a linking channel, sized to pass a standard amount from the supply part to a pouring chute. Nothing enters chute while box is tilted to pour; righting the box refills chute.



Mechanical envelope licker will save your tongue and eliminate the over-wet sponge that strips the flap of glue. Small enough to fit into the palm of your hand, the Office Pal moistens and seals flaps instantaneously with one motion.

makers, 19 Saucer Lane, Hicksville, N. Y.; (Heater) Hoffritz, 49 E. 34th St., NYC; (File) Tipdex, Ltd., 28 Martin Lane, London, England; (Carton) Alford Cartons, Ridgefield Park, N. J.; (Sealer) Columbia-Lamina, Box 306, Falls Church, Va.





Rubber 'Barrels' Take Bump Out of Chute Landing

Rubber cushions that look like barrels take up two-thirds of the shock when heavy Army equipment (see truck at left) parachutes to the ground. On the way down, Firestone's Aero Pallet Cushion fills with air and a valve automatically closes. The compressed air inside softens the landing, and then pops a cork to deflate the cushion.

Target Engine Ferries Glider

Don Stevens of Hemet, Calif., flies his glider to soaring meets by bolting on a small engine of the type used to power Air Force drone targets. The engine and gas tank come off quickly when he is ready to take off for a soaring flight.

Artificial Cloud Ices Helicopter

Helicopters seldom fly in clouds now, but the Canadians are testing the effects of icing that occurs in clouds by flying a copter in an artificial cloud created by the water-spray tower above. To de-ice, they land and whack the ice off with a stick.

Huge Diving Bell to Seek Torpedoed Treasure

More than 85 feet tall, the grotesque buoy above is actually a diving bell designed to recover gold from the German ship *Renate Leonhardt*, torpedoed in the North Sea in 1917 and now reported lying in 68 feet of water. A Dutchman named Piet Visser built the super diving bell just for the job. Manned by a crew of eight, it will be sunk directly over the wreck. A steel shaft (right) leads down to a workroom in the base. From this latter, tubes will probe through silt in which the hull is embedded to reach the treasure—$2,000,000 in gold.

Running toward the smoke, Gus saw it came from the hood of a car.

GUS STARTS THE MUSIC

By MARTIN BUNN

WHEN the immaculate 1940 Plymouth sedan drove into the Model Garage, bearing a Missouri license plate, Gus Wilson grinned. With the fall tourist season in full swing, you could expect all sorts of peculiar customers.

"How much," the driver of the Plymouth demanded, thrusting thin, irascible features out the window, "do you charge for cleanin' up a set of spark plugs?"

"Four bits," Gus said amiably, "with a breakdown test thrown in for free."

"Breakdown test," the character retorted. "That's the scheme you fellers use to wangle a man into buying new plugs—I'm wise to it. Nothin' wrong with my plugs that cleanin' won't fix. Clean 'em myself when I'm home on the ranch."

Looking at the car, Gus had an idea of how much of a ranch this man had in Missouri. It was 15 years old, yet the speedometer read only a little over 30,000. Its original tan paint shone from infinite care. The rear upholstery was immaculate, a blanket protected the front seat. It had the look of a car used by a small farmer or rural retired couple to go to town in on Saturdays.

"Me and Myra," the old fellow volunteered, "are bound east to see our daughter, and we don't reckon to be held up along the way by none of you slickers."

"Fine," Gus said, lifting the hood and snapping a long spark-plug socket on his power bar.

"Most folks," the driver went on conversationally, "don't know how to handle slickers, and get stuck by 'em. But me, I'm too smart. I got a mite of a miss, now and then, and right off I know what's the trouble. I know what I want done, so I ask fer it and git it. Name's Morton—Henry Morton."

"You certainly do, Mr. Morton," Gus said, as he took out the first plug.

THE condition of the plugs indicated that the old Plymouth was using a little oil, but not much. They were carbonized a bit, but otherwise in fair shape. Gus ran a breakdown test, and found two that he would have normally recommended be changed. However, considering the attitude of his customer and the fact that the plugs should give considerably more service in a motor that undoubtedly did not carry top compression, Gus thought it wise not to press for two new plugs.

"You folks are a long way from home," Gus commented as he replaced the cleaned plugs. "Everything else all right?"

"Right as rain," Morton said firmly.

"Now you know better than that, Henry," the gray-haired wisp of a woman sitting beside the driver suddenly inter-

jected. "Every time we hit a rough road our radio makes the most awful racket. I wish you'd have it fixed."

"Fixed!" Henry Morton snorted. "Now don't start that again, Myra. I let you waggle-jaw me into having it looked at a hundred miles back. That whipper-snapper back there charged me two dollars and said the thing was in good shape."

"I don't care if he did," the little old woman insisted. "It still raises Ned on rough roads, and I like music while we drive."

"I don't," Morton snorted. "I wish the danged thing would squawk and crackle all the time; then you'd never turn it on."

"It's about closing time," Gus said, looking at the office clock, "but maybe you'd better have me take a look at that radio. Sometimes when a radio cuts up on rough roads it could be . . ."

"There you go," Morton interrupted sarcastically, stepping on the starter and shifting into gear. "You fellers are all alike, tryin' to hook tourists fer somethin' as they pass through. A man's lucky to get home with his hair."

"You didn't have no hair to start with, Henry," Mrs. Morton reminded him. Gus had a time keeping his face straight.

"Now," Morton said, ignoring his wife's remark, "if you've got a eating house in this town where they don't rob nor poison a man, me and Myra'll eat."

"If you're going east," Gus said mildly, "you'll hit a reasonable place called the Twin Pines Inn. Take it easy, though. The town's putting in a new sewer line, and the street's torn up for a ways."

AS THE Plymouth backed out and went down the street, Stan Hicks, Gus's young helper, looked up from the grease rack with amusement.

"That guy," Stan commented, "just don't like music."

"Before he is through," Gus said thoughtfully, "he may wish he did."

It took Gus and Stan perhaps 20 minutes to clean things up a bit and get ready to close shop. Stan had just started up the tow truck to drive it inside, while Gus went to lock the office, when the wail of a fire siren came over the clear fall air.

Stan, a new and dutiful member of the town's volunteer fire company, scrambled out of the truck and reached the phone in six leaping strides to dial the operator and find out where the fire was. Then, brushing past Gus in the doorway in a dash back to the truck, he shouted, "Car on fire up by the Twin Pines Inn. I'll bring this bus back later."

"Officer Coogan reporting . . . There's been a little auto accident at Main and Elm . . ."

"Hold it, Stan!" Gus yelled. "I'm going this time—you lock up!"

With surprising speed, Gus trotted to the back room, grabbed his tool kit, emerged again at a lope, vaulted into the cab, half-shoved Stan out the other door, gunned the engine and roared up the street in a rubber-burning take-off.

Stan gaped after him in stunned surprise, since Gus had never been in the habit of chasing fire wagons.

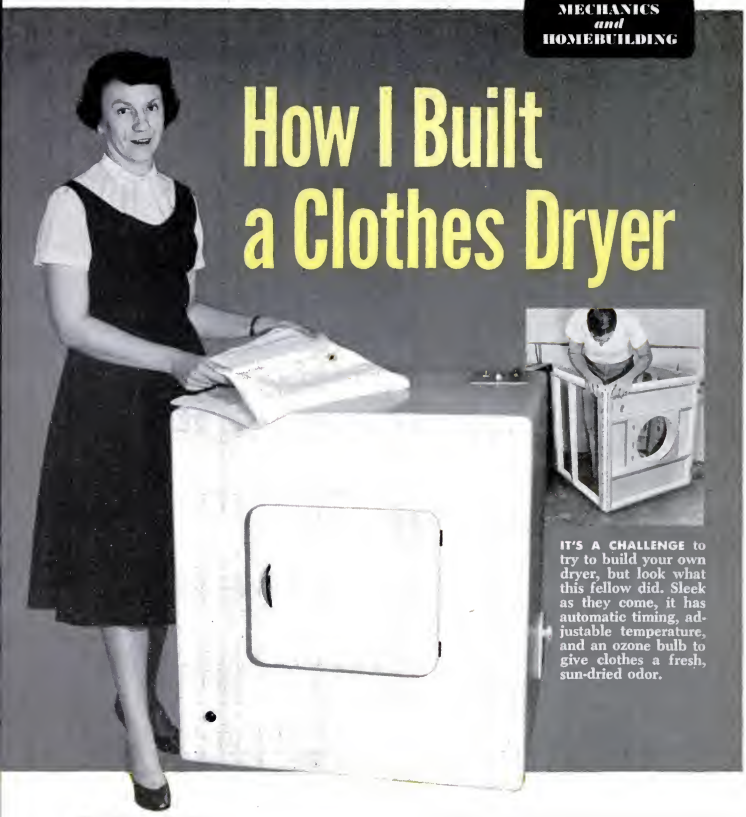
"Car on fire . . ." Stan mused, half aloud. "Twin Pines . . ."

By the time Gus hit Main Street he could see the flashing lights of the fire truck. He slowed down when he reached the section where the new sewer line was being installed; then speeded up again.

Coming to the edge of town he could see the fire engine pulled up at the Twin Pines Inn. From the center of the crowd of spectators a column of black smoke poured into the balmy evening air. As Gus drove up, Sgt. Jerry Corcoran

[*Continued on page 248*]

How I Built a Clothes Dryer



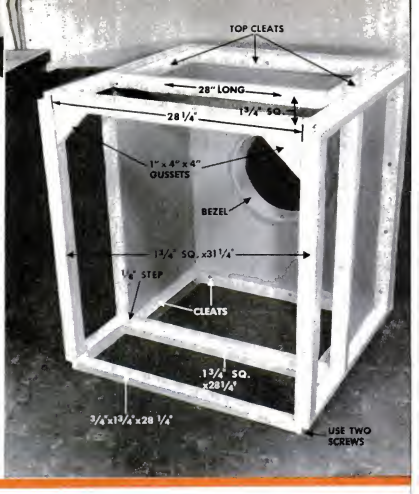
IT'S A CHALLENGE to try to build your own dryer, but look what this fellow did. Sleek as they come, it has automatic timing, adjustable temperature, and an ozone bulb to give clothes a fresh, sun-dried odor.

By Karl Greif

ONCE the woman of the house starts campaigning for a clothes dryer, a sensible man has two courses: buy it, or talk her out of it. I chose a third: I built one.

The decision was made after a wife-conducted tour of appliance shops. Looking behind the big price tags, I found a dryer was no great mystery. The basket or drum turned to tumble the clothes, a heater boosted inside air temperature, and a fan whisked the hot air around the wet clothes.

Sure, there are finicky refinements—a safety thermostat to shut down if the temperature gets too high, another you can set for different drying heats, a timer to control length of drying automatically, a governor that cuts off the heater if the air isn't circulating. You



Making the dryer cabinet is a straight woodworking job

CUT APART STOCK for the bezel (loading-port ring) as in the drawing, saw outside arcs, and round them off. Saw out inside, and use glue and 3" screws to attach the bezel inside the port. Then round the inside as above. Chisel recesses inside mortises for brackets to hold switch and door catches. Attach top and bottom lining to cleats screwed on from inside, as at right. Fasten gussets with screws only, not glue; they will have to be removed again to install the mechanism.

need a light inside for loading, and an ozone bulb to make a wash smell as if it had, after all, come off a sunny line.

It didn't look too big a job. I knew I could buy the complex items—thermostats, timer and relays—as standard items or replacement units. I had to get a 30-amp., 230-volt outlet installed, but any electric dryer would have needed that.

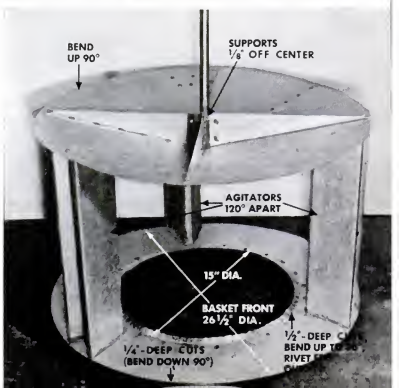
What it took. My parts cost was about a third what a tailor-made dryer costs. Taking a few weeks of spare time, the job was no one-evening project. But it was interesting, the result looks as good as the ones in the ads, and it works like a wife charmer. If you can make good wood joints and follow a wiring diagram, you, too, can grow an inch every time your wife says, "My husband made it."

Start with the cabinet. The drawing shows how it is made. Use ⅛" Transite asbestos board to heatproof the interior. By careful cutting and piecing, you can get all the lining out of one 4'-by-8' panel. Fasten it with glue and screws.

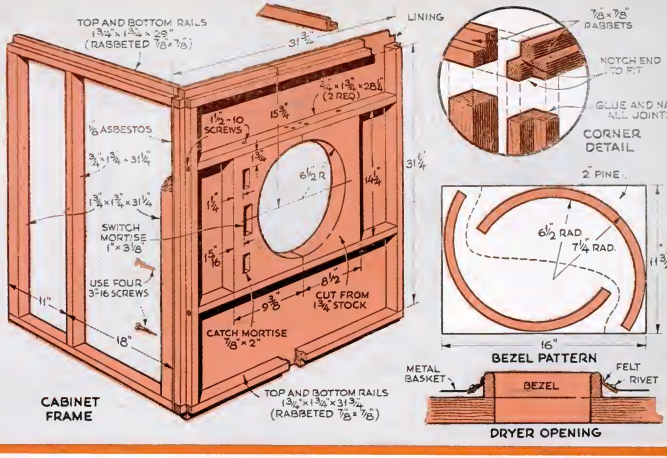
Cut the bottom of ⅛" hardboard panel to reach just to the inner rabbet edges, all around. Bore 1" holes through it at four corners, above the forward lining cleat and the rear bottom rail. Set in ⅜" drive-in nuts (Teenuts). Make a riser frame of 1¾" stock, bore matching holes

Rotating basket is sheet metal and square-mesh wire cloth

SAVE THE DISK cut out of the basket front. Slit all disk edges and bend as below, soldering the slits for extra strength. Rivet a 1¼"-wide felt ring outside the inner flange to run against the bezel as a clothes seal (see detail on facing page). Bend all agitator flanges inward, leav-



If you want cutting layouts for lining and sheet metal, ask for them before Dec. 1, 1955, and enclose a stamped, self-addressed envelope. Address Mechanics and Handicraft Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Ave., New York 10, N.Y.

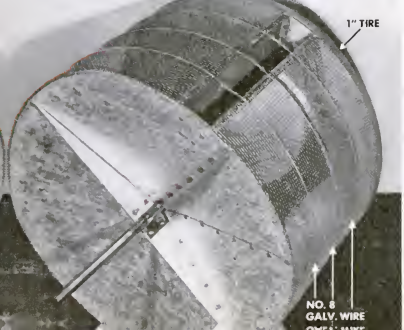


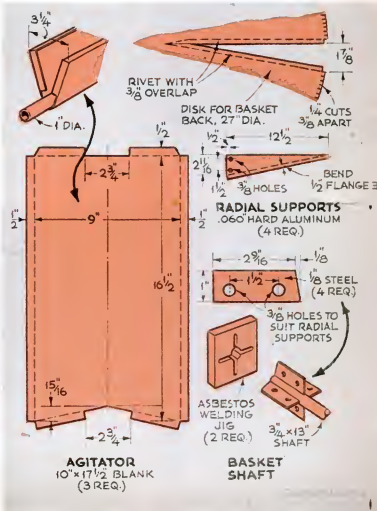
and screw in 3/8" carriage bolts as feet.

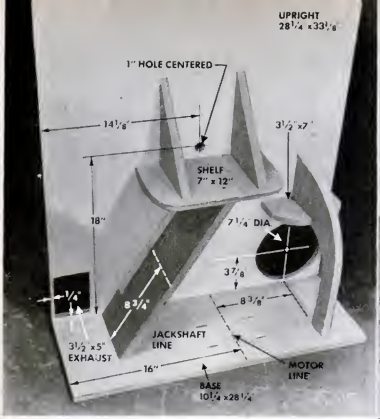
Building the basket. Buy a 30"-by-96" sheet of 24-gauge galvanized iron. Have the dealer shear off a 1" strip the full length for the basket tire. The rest makes all parts but the radial supports, for which I used aluminum. Rivet these to the cone 1/8" offcenter so shaft webs fit alongside, centering the shaft itself.

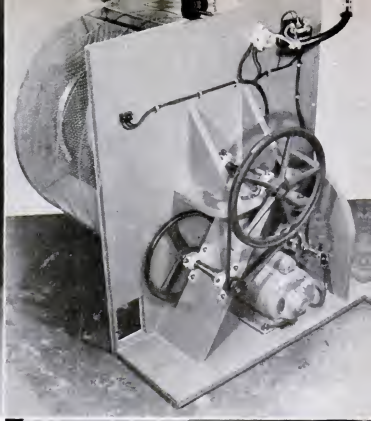
Motor and drive unit. I used a 1/6-hp., 1,725-r.p.m. motor and Oilite shaft hangers. Align the basket bearings so

ing no sharp edges to tear clothes. Rivet the short flanges to the basket ends. Cut three 18"-by-26" pieces of 1/4" wire mesh. Bend these around the agitator lips and flanges on the basket ends, and solder. Wrap three lengths of heavy wire around the mesh, twist the ends together inside the agitator gaps, and solder. After checking runout, solder the 1" tire around the basket.



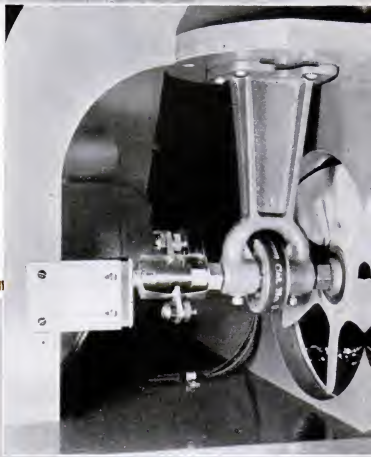


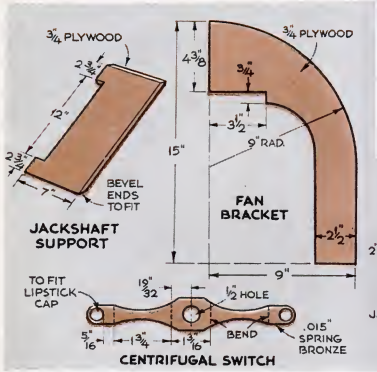


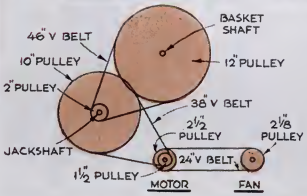


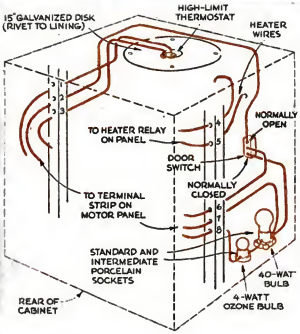
Drive mechanism is built as a unit to slide into dryer cabinet

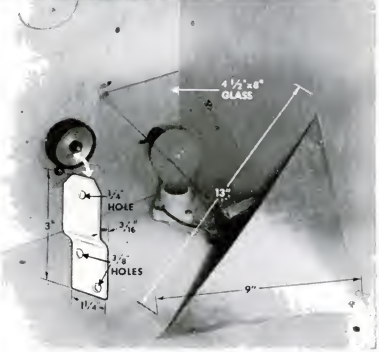
MAKE THE SUPPORT shown above out of ¾" plywood, the upright overlapping the base. Vertical dimensions are shown from top of base. Mount the shelves and brackets with glue and screws. Slot all bearing and motor-mount holes to allow belt adjustment. Heater relay is mounted on back of panel. A 7" fan is mounted on an Oilite-bearing polishing head, fastened upside down (right). Centrifugal switch cuts heater current if the fan is not running. Mount a normally-on snap switch on a plate bolted to the plywood fan standard, so that lipstick cap on the governor will depress its plunger when the fan shaft is not turning.











Insulation and part of the wiring go into the cabinet walls

RUN CABINET WIRING outside the lining as in top photo. Fill walls with layers of Fiberglas (three on top, two elsewhere). Set in a tube before the pilot bulb (arrow in upside-down view above) to pass light through insulation. To run wires around corner, bore into frame rabbet from two angles so that the holes meet, as shown in same photo.

PUSH DRIVE UNIT into the cabinet and slide basket shaft forward until tire touches the front lining. Spin it to scribe a ring. Lock the shaft ¼" back with a collar and the pulley. Bend two brackets to mount felt-covered skate wheels under the scribed ring as above. Mount glass deflector with small clips as shown, triangular deflector behind.

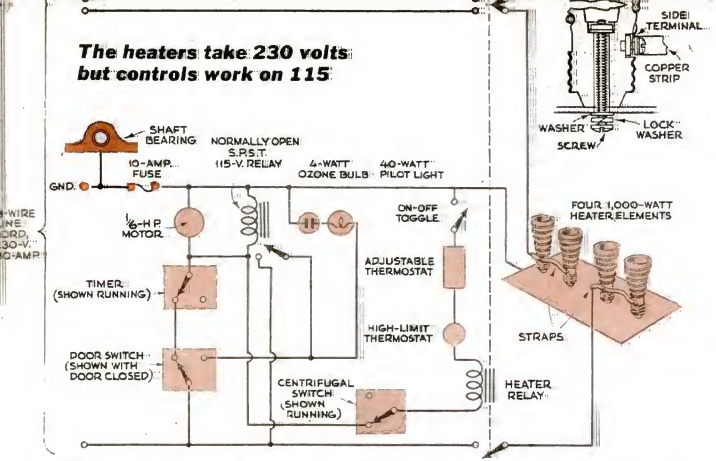
that the shaft is at 90° to the panel. With this laid flat, spin the basket and check runout, shifting the shaft webs until the basket front runs true. Clamp on the 1" tire so that it runs straight; then solder.

Clamp the centrifugal governor on the fan shaft between two nuts. Solder the ends to a lipstick cap that slides freely on the shaft. For weights, slit small pieces of brass, drill for bolts, pinch the slits over the springs, and solder.

Mount a 2½" hubless and a 1½" ordinary pulley on the motor shaft. Slide the motor and shim up either side as necessary to tension both belts.

Line motor panel. Cut needed openings in asbestos and screw it to the upright. Mount a piece of thick felt with a

HEATER UNIT FITS into top cabinet corner on fan side. Fasten a 12"-by-18" galvanized shield behind it and a 9" square to the front lining, using sheet-metal screws. Mount the heater, with No. 10 self-tapping screws, on washers to space it ¼" off the shield. Run No. 12 solid wires through reflector, shield and wall to emerge at center side post on that side.



POWER TO HEATER, which takes 4,000 watts, is controlled by a heavy-duty relay, but the coil of this relay, the thermostats and the small relay controlling the bulbs are all operated on 115 volts, taken off between one side of the 230-volt line and ground. The toggle switch cuts off the heater when only air drying is wanted. Use a regular range cord and three-prong plug. Run the center-prong conductor (ground lead) to one basket-shaft bearing. The wall receptacle is wired with No. 10 wires fused at 30 amp. Panel fuse is 10 amp.

½" hole in it over the hole for the shaft.

Run wires in walls. Both the high-limit and control thermostat are replacement units for a Sears, Roebuck dryer. Run wiring to these, the door switch, and two bulbs as on page 181, leaving leads to reach the motor panel and heater relay (a Potter-Bromfield PR7A).

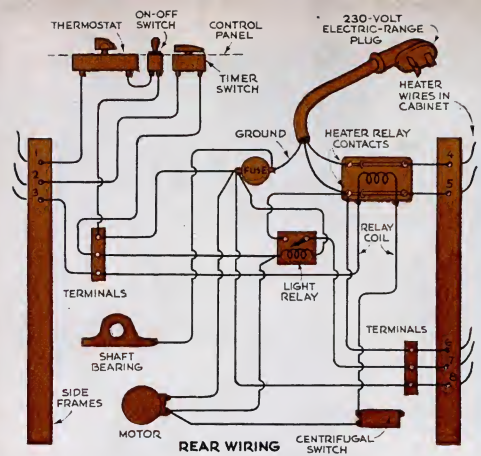
MOUNT CONTROL PANEL atop the ¼" composition board covering the top. Cut a 3" hole in disk saved from basket front. Mount it under but not touching the high-limit thermostat. Run tube from control thermostat in notch (arrow). Fasten to disk with cable clips.

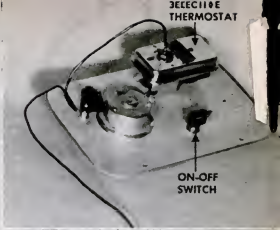
Heater has no sockets. Shape the heater body of .060" polished aluminum. Mount four 1,000-watt elements by their own center bolts as shown. Cut two copper straps. Fasten each to the side terminals on two elements, and to one 230-volt wire.

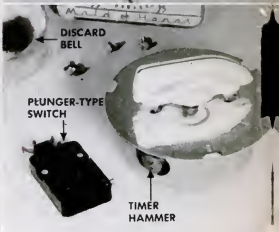
Enclose the cabinet. Glue and nail ⅛" hard composition board outside the walls, extending to the inner rabbet corners only. Cut holes for the door, pilot jewel and switch button in the front. Weatherstrip the plywood door.

Quarter-round molding, glued and nailed into the frame rabbets and fitted with double miters at the corners, gives a smart rounded look. Fill nail holes and apply white refrigerator enamel.

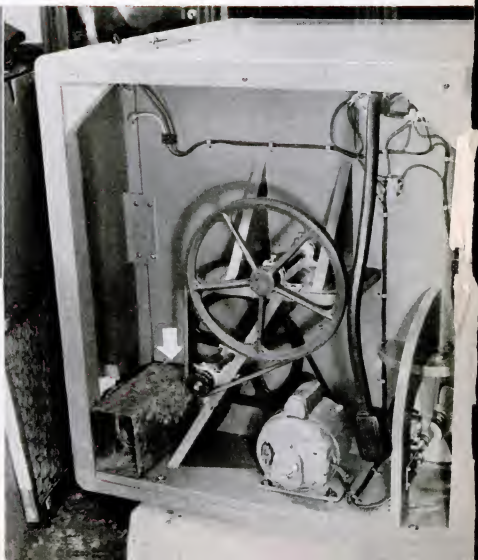
Level the cabinet and plug the dryer in with the timer off. The light should go on when you open the door. Load clothes; then set thermostat to medium, timer to 30 minutes for a trial run. Clean the lint trap after each use. END







CUT CONTROL PANEL (above right) from aluminum, which can be etched in a lye solution and lettered with India ink. Disassemble a one-hour timer (from a mail-order house) and discard the bell and case. Mount timer mechanism and a normally-on snap switch (set off on spacers) so that timer hammer will trip the switch. The on-off switch and control thermostat, which affords a choice of drying temperatures, are also fastened under the panel. The dial from the timer can be mounted on top of the panel to show setting.



BEND EXHAUST DUCT (arrow) of sheet metal. Mount behind port with a felt gasket. Lint trap is screening soldered to wire frame. Mount it at 90° to a plate (also with a felt seal) that will close trap opening in duct side. Fit door in cabinet side (above). Rubber block holds trap in. Cut a hole in back panel behind the duct, and a big one behind the fan. Mount a 16"-by-20" furnace filter behind this air inlet.

Pipe Cap Protects Chisel Head

A PIPE cap and short nipple slipped over a cold chisel will take the pounding that mushrooms the head of a chisel. Wind tape around the chisel shank if needed to fit.—*Frank A. Javor, N. Bergen, N. J.*

Emergency Jackshaft Still Runs

THIS started out as an emergency jackshaft, but has worked so well that I've never changed it. I cut a U slot in a scrap of hardwood, screwed on bearing blocks, and drilled through for the pulley shaft. The pulley hanger, beveled at the bottom, is hinged to tilt at various angles.

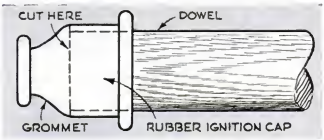
I lubricate the wood frequently, and it makes a fine free-running bearing.—*J. W. Rocke, Atkinson, Nebr.*

Paper Clips Join Radio Wires

PAPER clips offer a quick way to clamp radio wires together while you're making temporary tests. Use them, though, only on those connections carrying low voltages and take care not to let them touch other wires or the chassis so as to short or ground.

Ball Pens Make Test Prods

YOU can make an extra set of electrical test prods from a couple of discarded ball-point pens. Solder a phonograph needle to an insulated wire and push the wire into the top end of the pen until the needle sticks out the tip. Pull on the needle with pliers so that it wedges in tightly.



Plug Cover Gets Extra Work

THE stores were closed when I needed a grommet to run wire safely through a metal panel. I cut a rubber spark-plug nipple off at the shoulder, using a dowel to support it. The upper part made a perfect grommet.—*S. Clark, East Bradenton, Fla.*

With the proper supplies and know-how

You Can Solder Aluminum

By John Burroughs

WANT proof that solder will stick to aluminum? Look at a Westinghouse lamp bulb. One filament lead is soldered to the threaded aluminum base.

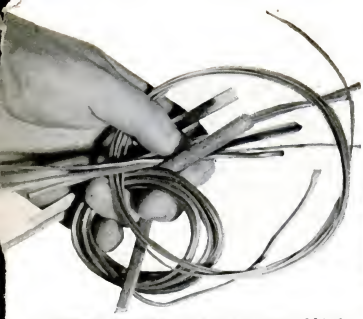
Want proof that solder won't stick to aluminum? Try soldering a leaky aluminum pot with a good iron, regular solder and your favorite flux. No soap.

It takes special stuff. To begin with, you need special solder. A few packaged brands are sold in hardware stores. Many good ones are industrial products, sold only in bulk. However, all aluminum solders can be classified in three broad groups:

- Lead or cadmium-base alloys, low-melting solders that run at about 500°F.
- Tin-base solders, generally containing 50- to 75-percent tin (the rest is zinc) and also melting at about 500°.
- Zinc-base solders and brazing alloys. These melt at temperatures up to 1,100° F. and so call for gas welding equipment. (The American Welding Society calls any aluminum solder that melts at 800° or more a brazing alloy.)

As with ordinary solders, those with a higher melting point have greater strength and corrosion resistance. But for ordinary household use, the low-melting solders have

A LEAK PLUGGED is a pot saved. Use only lead-free (tin base) solders for food or drink utensils. Blowtorch supplies heat.



ALUMINUM SOLDERS come in a variety of kinds, shapes and sizes. Some are sold only in bulk. Whichever you buy, be sure to get directions and the right flux to go with it.

been found to be very satisfactory.

It takes special flux. The instant a fresh aluminum surface is exposed to air, a tough, transparent and quite unsolderable coating of aluminum oxide forms over it. You can scrape this off, but there are more new oxide coats underneath than there are layers in an onion.

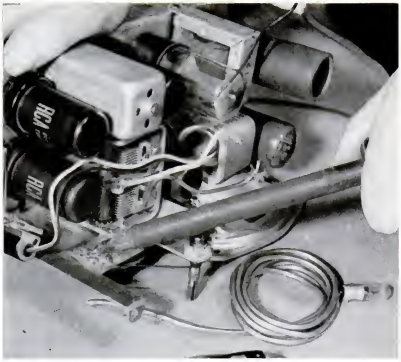
Aluminum soldering fluxes remove this oxide. To keep a new film from forming, the metal must be kept covered with flux until coated with solder. Scrape the surface clean, use plenty of the flux recommended for the solder, and try not to burn or displace the flux when heating the joint.

You can buy flux-cored aluminum solders, which are all right for light jobs such as electrical connections. For anything heavier you'll need extra flux.

It takes lots of heat. Aside from the higher melting point of aluminum solders, you also have to buck the fast heat conductivity of the metal itself—it draws calories away faster than you can flap a wet rag, about three times as fast as sheet iron.

With a low-melting aluminum solder, you can just coax enough heat out of a good electric soldering iron to join thin sheet aluminum. Anything heftier calls for a torch. A plumber's gasoline blowtorch will do with lead or tin-base solders. The new pressurized butane torches are more convenient. An air-acetylene

An iron serves for light work



SMALL JOBS such as soldering to an aluminum radio chassis can be managed with a good hot-soldering and low-melting aluminum solder. The flux-cored kind can be used here.

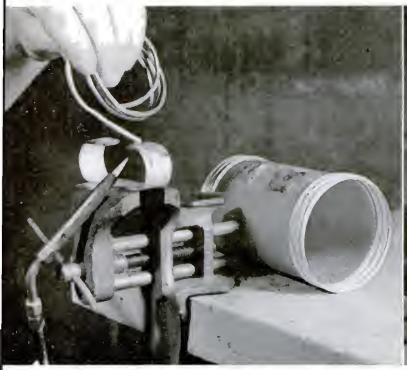
outfit is better still and, of course, if you have oxyacetylene equipment you can do anything up to aluminum welding.

Having supplied yourself with special solder, the right flux and plenty of portable heat, the next step is tinning the aluminum (coating it with a film of

Soldered home repairs save money

INHALING A MARBLE did this to the blower housing of a vacuum cleaner. A sheet-metal patch was cut and bent to fit inside the hole.

Both parts must be tinned to make a strong sweated joint



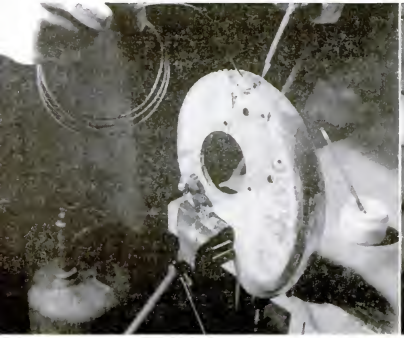
A TORCH IS BEST even for small jobs like replacing a handle torn off this cookie press. First the handle surfaces and corresponding areas on the barrel were scraped clean and tinned with flux-cored aluminum solder (above left). Handle was held down and heat applied to sweat the joints (above right). Then extra solder fillets were flowed along the edges.

solder). This sometimes takes more patience than you thought you had.

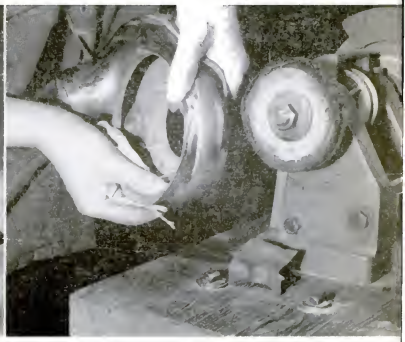
It takes care. Apply the flame so that it heats the joint by conduction; try not to play it directly on the flux or the solder. When the flux bubbles and fumes, the work is at soldering temperature.

Rub on the solder. If it doesn't flow on and stick, rub on a puddle and then scrape through the molten solder with a toothed tool (a fragment of hacksaw blade for instance). This scraping helps the flux break up the oxide film, while the molten solder keeps air away and

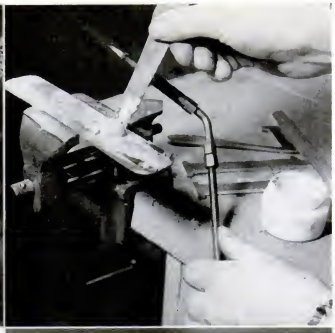
A patch provides a backing against which to flow in metal

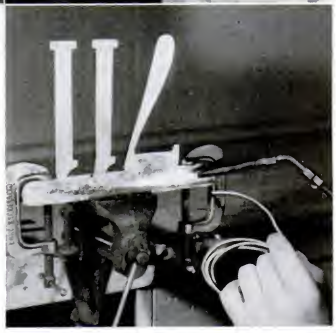


PATCH WAS WEDGED in place, flux applied, and the casting heated with a torch. Molten solder was puddled about to eliminate pockets.



WHEN THE PATCH COOLED, excess solder was filed off and the area polished with abrasive cloth. Buffing on a wheel polished it.





NEW WORK TOO may call for aluminum soldering. To avoid putting screws through this handsome house number, cut from ⅛" aluminum plate, a mounting strip was tinned lengthwise as at right above, by rubbing molten solder in with a toothed tool. The top edge of the numbers was also tinned. Then they were clamped to the strip (below right), heat was applied, and solder fillets run along both sides. Flux was washed off and the piece polished.

thus prevents new oxide from forming.

If this doesn't work, try scrubbing the hot solder into the aluminum with a wad of steel wool held in a pair of old pliers or in a slotted metal rod.

If the solder still won't stick, wipe off everything and start fresh. Tinning the parts is the toughest part of the job. Once you have a coating of solder on both pieces, sweating them together is easy. You don't even need the special solder any more. Ordinary lead-tin solder will stick to most aluminum solders. Therefore you can use it if extra solder is needed, or to tin non-aluminum parts to be soldered to aluminum.

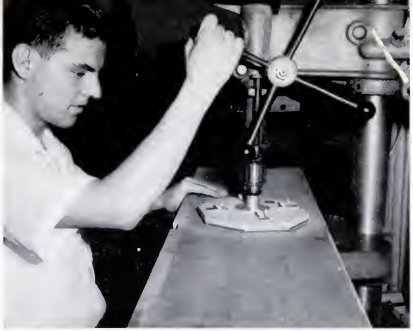
The difference in melting points is sometimes an advantage, too. For example, if two joints must be made close together, sweat the first with aluminum solder and the second with ordinary solder. Requiring less heat, this can be melted in without opening the first joint.

After the soldered work has cooled naturally in air, wash off any remaining flux with hot, soapy water, inspect and test the joint, and give yourself a kind word for a job well done.

Do it the easy way. If by now you've decided that soldering aluminum is more trouble than using a bolt or rivet, you're right. Where a mechanical fastening will serve, by all means use it.

Practically all aluminum alloys can be soldered like aluminum, with the exception of those containing magnesium. Cast aluminum is usually harder to solder than the rolled or extruded kind.

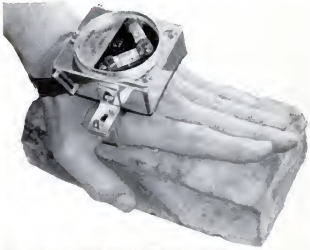
Remember that soldered joints are relatively weak. Any broken aluminum part that has to carry a real load, such as a machine part, should be brazed or welded. (Soldering large aluminum sheets together is not advisable either—they warp and buckle when heated along the edge.) But many a piece can be salvaged by soldering, as the photos show. END



New Tools

1. Sander Takes Square Paper. This octagonal sander lets you use standard 8″ squares of paper without cutting circles or gluing them on. Corners of the paper are quickly folded behind it and clamped under four wing nuts. An adapter permits the plate to fit in any ⅜″ chuck or on any ½″ shaft.

2. Knife Sharpener Edges Tools. You can grind edges on small tools with this sharpener. Its dome has knife-guide slots, but you can snap it off to expose the wheel.

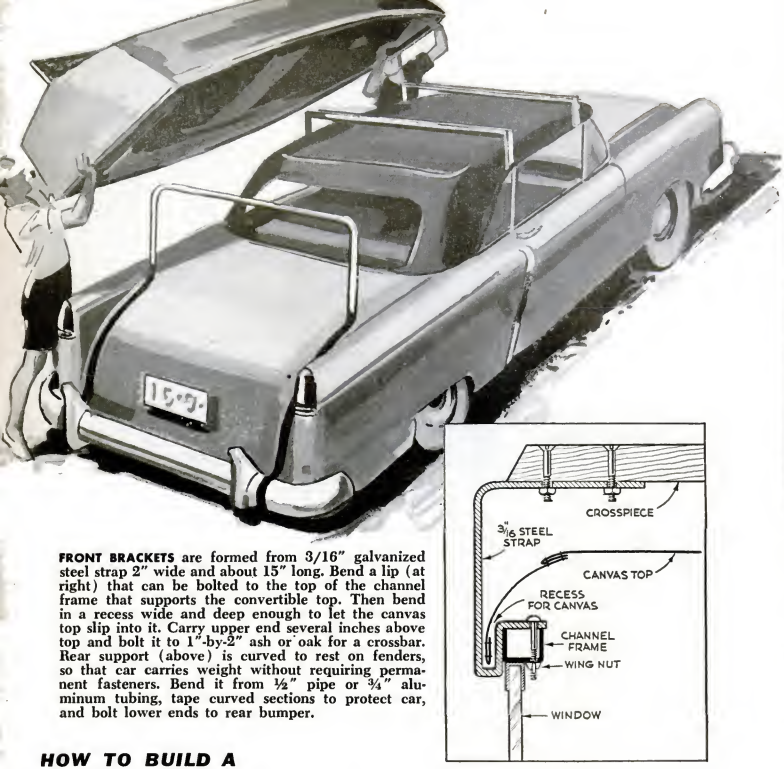


3. Level Speeds Bricklaying. With this spirit level strapped on his hand, a mason can level each brick as he sets it in the wet mortar, and still grip his trowel in the other hand.

4. Jig Lines Up Saw Fence. Accurate alignment of a saw blade and fence is assured by this jig. You tighten the thumbscrew of the Fence-Aliner on the blade, lock the fence against the outer end, and rotate the blade from front to back. If the jig touches all the way but doesn't bind, the saw blade and fence are parallel. The jig can be used on tilting-arbor or tilting-table saws.

5. Two-Piece Tool Does Dozen Jobs. Built-in angles and wing-nut adjustments enable the two-piece Sawsitsquare, its maker says, to serve as a guide, protractor, compass, square, level, caliper, miter, and as a half-dozen other wood-marking tools.

Further information about the products decribed on this page can be obtained from: 1. Singley Specialty Co., Hendersonville, N.C.; 2. Burgess Vibrocrafters, Inc., Grayslake, Ill.; 3. Handy Mason's Level Co., 135 W. Wells St., Milwaukee, Wis.; 4. Adams Products Co., 119 Ann St., Hartford 3, Conn.; 5. Newmon T. Brown, 2206 Haste St., Berkeley, Calif.



FRONT BRACKETS are formed from 3/16" galvanized steel strap 2" wide and about 15" long. Bend a lip (at right) that can be bolted to the top of the channel frame that supports the convertible top. Then bend in a recess wide and deep enough to let the canvas top slip into it. Carry upper end several inches above top and bolt it to 1"-by-2" ash or oak for a crossbar. Rear support (above) is curved to rest on fenders, so that car carries weight without requiring permanent fasteners. Bend it from ½" pipe or ¾" aluminum tubing, tape curved sections to protect car, and bolt lower ends to rear bumper.

HOW TO BUILD A

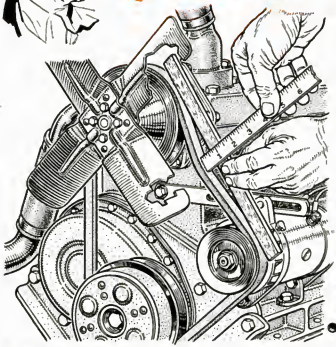
Car-Top Rack for a Convertible

WHEN I had to move a small boat and my convertible 3,000 miles across the country, I thought I'd have to sell either the car or the boat—you just can't rest a boat on the soft top, and commercial carriers don't fit on convertibles.

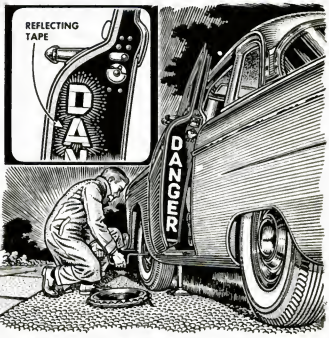
With this rig, I didn't have to sell either one. Two crossbars bolted to the top's frame take the front load, and a U-shaped support bolted to the rear bumper handles the hind end. Now, besides carrying the boat, I can use the front supports as a luggage rack and the rear one to haul long loads like lumber.

Lashing the load between front and rear supports braces the rear one against any tendency to slip backwards. In sudden stops, the rig isn't likely to become a projectile since it's bolted right to the car.—*J. A. Anderson, Norfolk, Va.*

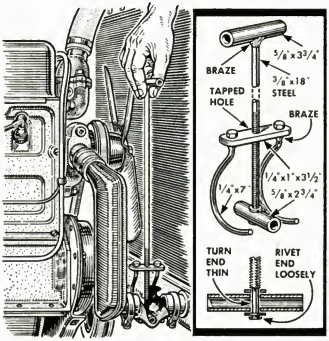
Hints FROM THE MODEL GARAGE



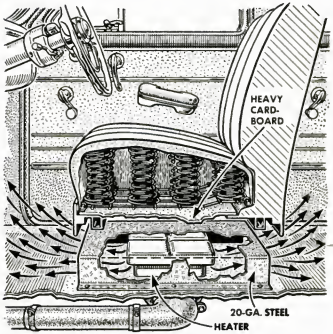
A straightedge placed across the pulleys on the generator and fan provides an easy means of checking the deflection of a fan belt when adjusting it. Specifications vary slightly for different cars, but ⅜" deflection is a good average adjustment.



Flash a brilliant warning to oncoming motorists at night by arranging strips of red fluorescent tape to spell out DANGER on the edge of your left front door. It will be visible every time you open the door or make roadside repairs.



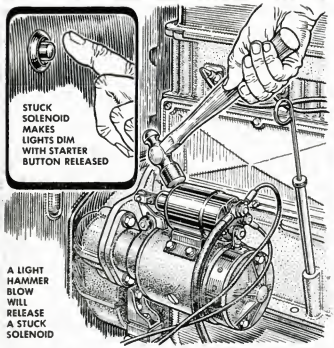
Almost like a mechanical hand, this tool bends a replacement radiator hose and positions it between the lower radiator connections. Unscrewing the handle straightens the hose and it is then nudged over the fittings by hand.



Minimize heat loss this winter by making a sheet-metal duct to fit over an under-seat heater. The duct, open at both ends, permits free circulation, yet prevents the heat from rising and accumulating in the spring pocket under the seat.

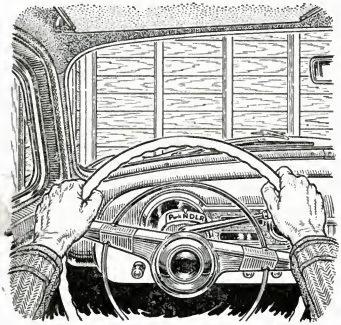
Please turn the page for more auto hints

MORE Hints from the Model Garage

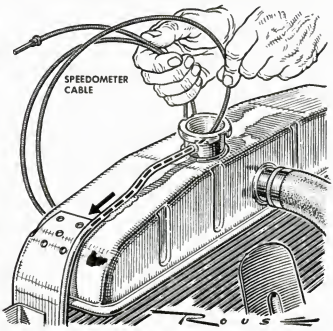


When an engine won't start after slow cranking in cold weather, the starter pinion-gear sometimes stays in mesh with the flywheel gear, holding the contacts together. You can check this by turning on the dash lights before starting. If they remain dim *after* cranking, tap the solenoid to release the plunger and open the contacts.

Old rugs can be useful around a car. Instead of throwing them out, cut them up, stow a few pieces in the trunk and leave the rest in the garage. Spread them on the ground or over dirt or mud when making repairs or changing a tire. If you get stuck in snow or mud, toss one under a rear wheel for traction.



If you leave the steering wheel just as it is when the car is driven into the garage, you'll back out exactly as you came in. Similarly, after maneuvering into a tight parking space, leave the wheel as is for a quick exit.



An old speedometer cable, removed from its housing, makes a good flexible snake for cleaning a clogged overflow pipe. This is important maintenance because pressurized cooling systems relieve excess pressure through the overflow pipe.

He Uses 6-Volt Radio in 12-Volt Car

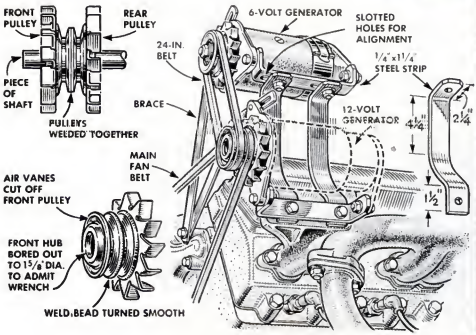
SUPPOSE you bought a new car with a 12-volt system and wanted to transfer to it a two-way radio that ran only on 6 volts.

This is a problem facing many police and other departments that operate radio-communication systems.

When it confronted Glen Connor, an Indiana conservation officer, he went into a huddle with mechanic Roy Duke, who then installed a separate 6-volt generator and battery.

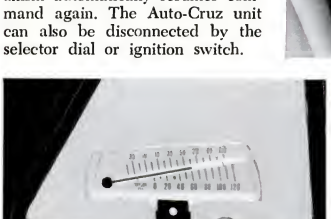
Mounting the 6-volt generator on a bracket above the 12-volt one, he removed the original generator pulley and welded a second pulley to it; then cut off the extra air vanes and trued the rough weld bead. The crankshaft pulley drives the fan belt and 12-volt generator, and a second 24″ belt on the added pulley turns the 6-volt generator. A 6-volt condenser and voltage regulator complete the circuit. Duke used a heavy-duty wire, No. 14 insulated.

The radio is wired through a fuse block to the 6-volt battery. It works better because the ignition, lights and other accessories are fed by the 12-volt system.



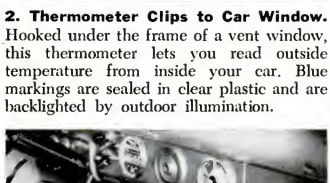
New for Your Car

1. Governor Sets Cruising Speed. Dial any speed over 30 m.p.h., take your foot off the accelerator, and this device will automatically maintain speed for you. A vacuum slave unit and centrifugal governor combine to hold the car speed constant. To pass or slow down, you hit the accelerator or brake in the normal way. But when you lift your foot, the speed mechanism automatically resumes command again. The Auto-Cruz unit can also be disconnected by the selector dial or ignition switch.



2. Thermometer Clips to Car Window. Hooked under the frame of a vent window, this thermometer lets you read outside temperature from inside your car. Blue markings are sealed in clear plastic and are backlighted by outdoor illumination.

3. Bumper Clamp Carries Bicycle. This Bike Toter may be just what you need to hitch a two-wheeler on your car. It consists of a sturdy metal rod, U-bolted to the bike frame, that drops into a socket clamped to the car's rear bumper.



4. Litter Bag Slides Under Dash. Even more convenient than an open window, the Sto-It collects your trash, slides under the dash when not in use. Disposable paper liners fit the fabric bag and can be changed easily when you get back home.

Further information on these new car products can be obtained from: 1. C. K. McCullough Co., 1307 E. Cross St., Anderon, Ind.; 2. Taylor Instrument Companies, 95 Ames St., Rochester 1, N.Y.; 3. Pope Mfg. Co., Prairie View, Ill.; 4. Berkshire Specialty Products Co., 63 Park St., Adams, Mass.; 5. U.N. Gram Pub. Co., 220 E. 46 St., NYC 17; 6. Vari-Products Co., 2450 S. Prairie, Chicago.

5. Guide Troubleshoots Car. On-the-spot diagnosis of many car troubles can be made by dialing a symptom on this card-wheel and reading the service data that appear in the window. The 7" Dial-A-Gram includes mileage check lists.

6. Reflector Guards "Sitting Duck." Plastic reflectors, long used by truckers for protection on roadside stops, are now available in glove-compartment size with folding stands. The Vari-Flare comes with a red flag for daytime use.

ALMANAC
FOR MOTORISTS

Pithy proverbs, provident counsel and omens and portents of interest to horseless-carriage operators.

▶▶**Wet leaves** on the ground just now are an overture to the poor-traction months. If the footing is bad, go easy on the brakes and steering wheel—which is simple if you go easy on the gas.

▶▶**With days getting shorter now,** you are more likely to be driving home from work or out to dinner at dusk. Don't let this creeping darkness catch you with your headlights off or your accelerator foot on. Remember: twilight cuts your vision—it should also cut your speed.

▶▶**Of the evil things** that age brings a car, a worn front end is among the most distressing. Tramp, wheel-fight and sloppy bushings don't go away when you ignore them. All that may depart is total control.

▶▶**Of course those spare fuses** are still in the glove compartment. But it won't hurt to check. It's no fun navigating a dark road by starlight and eight paper matches.

▶▶**Now at antifreeze time** it's wise to test the thermostat in the cooling system. Replace it if it sticks open—you'll have better warm-up, a more comforting heater, less oil dilution.

▶▶**Bet you haven't rotated tires** in the last few thousand miles. The rear ones go diagonally to the front; the left front marches to left rear; right front to spare, and spare ends up on right rear.

Homemade Charger Works

By Herbert R. Pfister

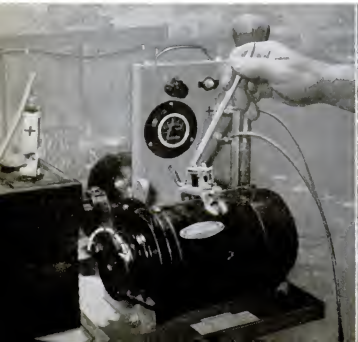
YOU can have midsummer starting in winter's zero weather with a generator charging rig like this one to keep your car battery "hot." Without removing the battery, you can hook the charger to it and turn it on. Disconnect it in the morning, slam down the hood and you're off. It will also get you going if you find the battery dead.

To build it, shop the junk yards for a third-brush generator common to '37 and '38 Chevvys, Pontiacs and Oldsmobiles. They are cheap, and the adjustable third brush lets you vary the output to suit battery needs.

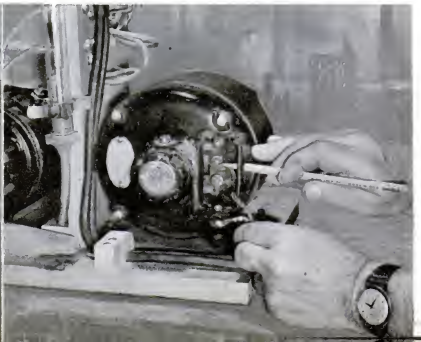
Assembly. Screw two hardwood blocks to a piece of ¾" plywood to support the generator. Fit a 3" pulley to a ¼-hp., 1,725-r.p.m. motor and bolt the motor to the base. Between the two units attach a slotted hardwood strip to lock the generator against belt tension. Also in this space screw a panel to support the ammeter, switch and indicator light. Attach two spring clips on one edge to store a battery hydrometer.

Motor wiring. Cut one leg of the line

CHECK DIRECTION of the generator's rotation before putting it in operation by connecting charging cables to the battery and closing the cutout-relay points. Most generators turn clockwise (arrow). Mark the battery clamps to show which is positive and which negative.



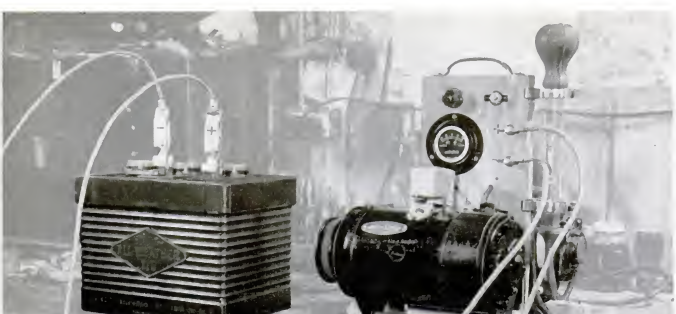
REVERSE THE MOTOR, IF NECESSARY, to drive the generator in the proper direction. Disconnect the line cord and switch the two motor wires on the terminals (pencil). If cutout points flutter when the generator is operating, reverse the connections to the battery.



While You Sleep

BATTERY HYDROMETER
CARRYING HANDLE
TOOL CLIP
ON-OFF TOGGLE SWITCH
INDICATOR LIGHT
¾" PLYWOOD PANEL, 5" x 12"
#14 WIRE TO BATTERY
AMMETER
TERMINAL POSTS, ¼" BOLTS
1,725-R.P.M. MOTOR
FIELD LEAD GROUNDED TO FRAME
CUTOUT RELAY
3" PULLEY
ARMATURE LEAD FROM BRUSH
V-BELT TENSIONER
LINE CORD
RUBBER-HEAD TACKS
HARDWOOD SUPPORTS
¾" PLYWOOD BASE, 11" x 13"

ADJUST CHARGING RATE by shifting third brush. Loosen lock screw and move brush arm, right to decrease output, left to increase it, while generator is running; then tighten lock screw when ammeter shows desired output. Moving brush can vary output from zero to 25 or 30 amp.



ON BENCH, battery can be properly maintained. Clean case with baking-soda solution and flush with water. Scrape terminals bright. Keep filler caps on and don't smoke—spark from terminal clamps or cigarette can cause explosion of hydrogen gas generated during charging.

CHECK SPECIFIC GRAVITY of electrolyte with hydrometer to determine approximate charging time. If water has been added, charge the battery for a half hour before checking to allow electrolyte to mix with fresh water. The chart below gives average charging time at 7 amp. for various battery conditions. Check specific gravity occasionally during the charge.

SPECIFIC GRAVITY	BATTERY CONDITION	CHARGING TIME
1.265 to 1.290	fully charged	none
1.235 to 1.260	three-fourths charged	6 hours
1.205 to 1.230	one-half charged	12 hours
1.170 to 1.200	one-fourth charged	18 hours
1.140 to 1.165	barely operative	24 hours
1.110 to 1.135	completely discharged	30 hours

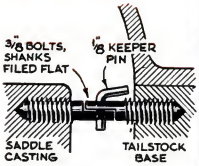
cord and run it through the on-off switch to the motor. Run the other leg direct to the motor.

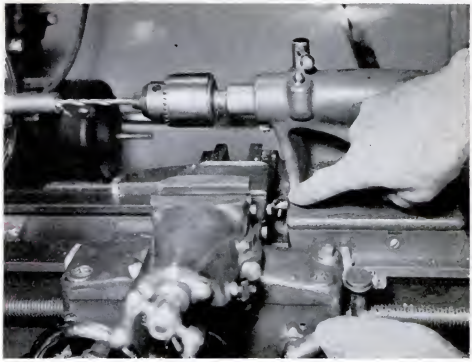
Generator wiring. Connect the armature lead to the side of the cutout relay marked GEN. Run a short wire from the BATT. side of the cutout to the input side of the ammeter. Continue with a second short wire from the output-side of the ammeter to the positive battery-cable terminal. Connect the negative battery-cable terminal to the field terminal on the generator. Use No. 14 wire for all connections.

Operation. Adjust the third brush while the generator is running until the ammeter reads 7 amp. An overnight charge at this rate will usually bring a half-discharged battery up to full capacity. If you should run the battery down trying to start on a cold morning, set the third brush for full output (25 to 30 amp.) and charge for a half hour. Then kick the engine over while the charger is still operating.

Sometimes a badly sulfated battery can be saved (but never fully restored) by a prolonged slow charge of 2 or 3 amp. for about 48 hours. END

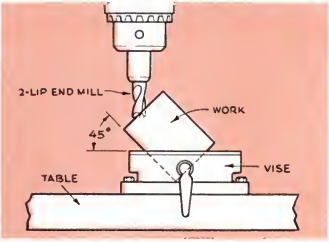
NEW Shop Ideas





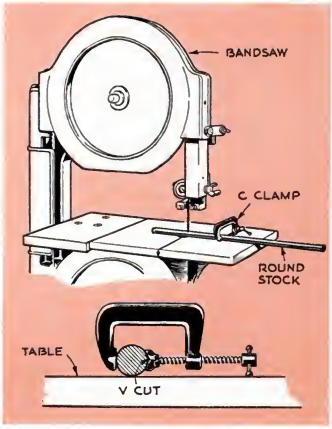
Lathe Carriage Pulls Tailstock. A lathe tailstock can be advanced automatically for tapping or smooth reaming by coupling its base to the saddle of the carriage.

The coupling, two cut-down bolts with their shanks filed flat to overlap, is linked by a pin bent from ⅛" rod. Then the carriage feed is engaged to set the carriage in motion, in the direction of the headstock, and the tailstock follows at the speed set by the lead-screw gears.—*Phil McCafferty, Stanwood, Iowa.*



End Mill Starts Angled Hole. Even using a center drill, it's hard to start a hole accurately in work held at an angle. The drill has a tendency to slip downhill. Best way is to center the layout mark under the center drill and clamp the workpiece. Chuck an end mill in the drill press to spot-face the area to be drilled, then start the hole with the center drill and finish with a drill.—*Frank LaSaracina, New York City.*

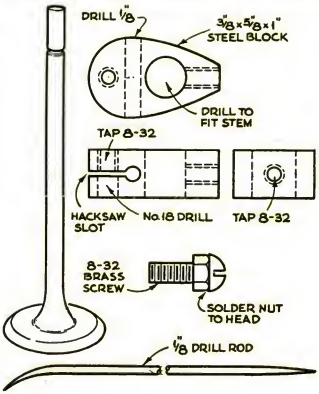
Fitting Ball Races. New ball bearings will slip onto a tight shaft more easily if you first lay them on top of a burning electric light bulb for a while. The slight expansion does it. On cooling, the bearing will fit snugly.



C Clamp Grips Round Stock. When cutting round stock with a bandsaw, grip it securely with a C clamp to keep it from spinning with the movement of the blade. A V cut filed in the pad on the clamp screw gives it a better grip and will keep the stock from slipping.

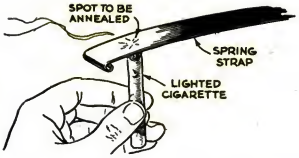
Please turn the page for more shop tips

MORE SHOP TIPS



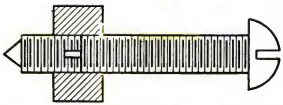
Valve Supports Surface Gauge. It's easy to make a useful surface gauge if you start with an old auto valve. Pick one that is not warped. Scrape off all carbon, chuck it in the lathe or drill press, and turn slowly to make certain the head is square to the stem. Polish all over under power, using fine abrasive cloth.

File, drill and tap the scriber block as shown in the drawing. Fit it with knurled screws, or solder nuts to ordinary ones as finger grips. File both ends of the scriber to points; then bend one as shown.



Good Excuse For Smoking. Use a lighted cigarette to spot-anneal thin stock for drilling. The heat is concentrated over a small area, annealing it without affecting the temper of the metal around it.—*Hugh Lineback, Stillwater, Okla.*

Glass Surface Plate. The extreme flatness of good-quality plate glass makes it an excellent surface for laying out or making precision measurements with a surface gauge or a machinist's square. Small squares of plate glass prove their flatness by sticking together like precision gauge blocks.—*J.M. Finn, Pittstown, N.J.*



Long Hold for Short Screws. Trying to grip a setscrew in the fingers for grinding a point on it rarely works. Instead, turn it, head end first, halfway into a thick nut. Then jam a long bolt of the same size against it for a handle (above). To do the job in a lathe, simply cut the bolt head off.—*Federico Strasser, Santiago, Chile.*

Do you know all these?

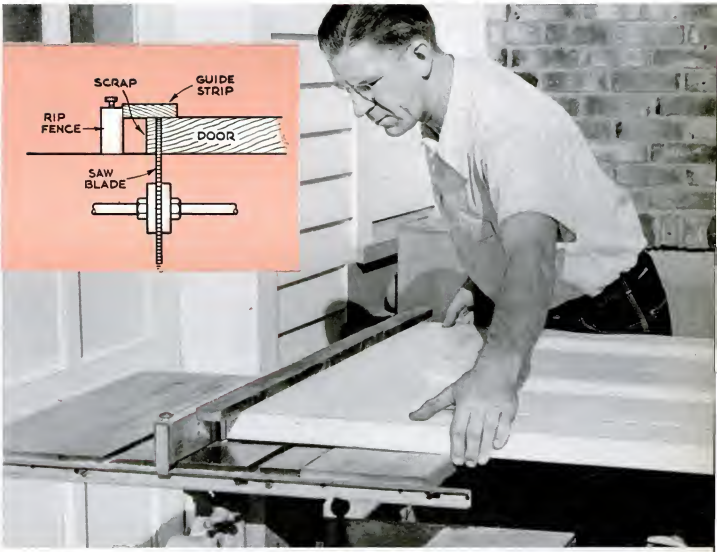
14 Useful Setups for a Circular Saw

By Glenn A. Wagner

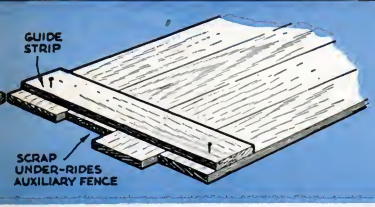
A CIRCULAR saw is one of the most useful power tools you can own. But like other shop equipment it does its best and most versatile work when you know how to set it up.

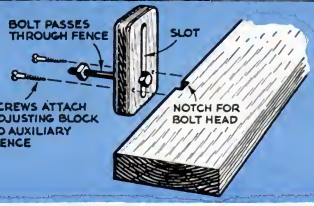
If you are resourceful, you can improvise jigs, patterns and guides that will let you cut accurate tenons and dadoes; miter, lap and dovetail joints; moldings, rabbets and tapers. A circular saw can even become an unerring duplicating machine, turning out any number of identical, odd-shaped parts.

Here are 14 out-of-the-ordinary setups that will pay you dividends on many kinds of table-saw work.



1 **USE THIS SETUP** to trim the ends of large panels or doors. Tack a 3"-wide guide strip to the face of the work, parallel to the trim line and overhanging the edge. With the saw adjusted to pass just through the work, slide the guide strip along the rip fence.





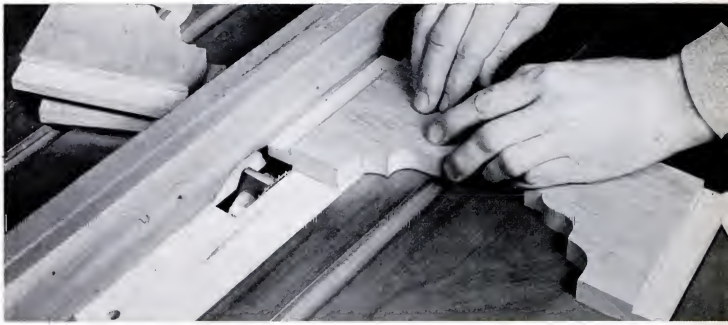
2 TO SQUARE OFF THE END of a table top formed of boards of varying lengths, tack a strip of plywood flush with the trim line and slide it along an auxiliary fence set flush with the outside of the saw. Underriding stock is cut off evenly along the strip, without shifting.

3 USING THE SAME FENCE SETUP, you can shape any number of identical, odd-shaped parts. Cut a wood pattern to the exact size and shape of the parts you want to make. Tack it to the stock and slide each edge of the pattern along the auxiliary fence for matching cuts.

4 A WIDE BOARD, screwed to the crosscut guide, supports stock for dovetail cuts. Use a stop block to position the work. If the dovetail pins are evenly spaced, use one stop-block setting for each pair of cuts, reversing the stock for the second pass of the saw.

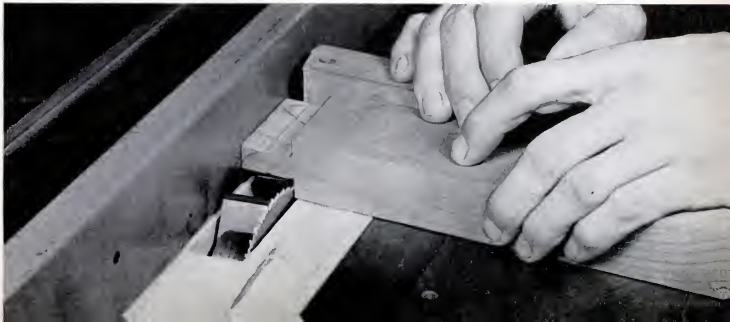
5 THE RIP FENCE serves as a stop block in this alternate dovetail-cutting setup. Clamp a scrap strip to the crosscut guide to back up the work. Shift the fence for each set of cuts, and move the guide support, whenever necessary, to keep it from striking the fence.

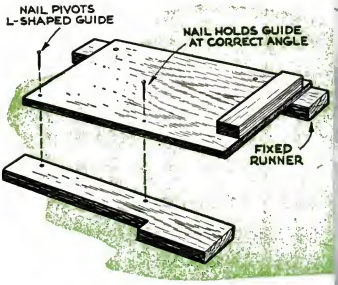
6 FOR TENON CUTS, mount a molding head beside the saw blade. Use a large, thin washer to separate them. Make sure the saw diameter is ⅛" larger than the sweep of the cutters. With this setup, the saw severs wood fibers before surplus stock is chipped out.



7 IF A TENON MUST BE LONGER than the cutter is wide, reset the rip fence for a second pass. For shallow tenons, above, use a supplementary fence with a recess for the cutter head. Bolt it to the side of the regular fence and adjust for tenon length.

8 WHERE STOCK THICKNESSES VARY, make all of the tenon cuts on the face side of the stock first, using one cutter-depth setting. Then check and adjust the setting individually for each pair of second-side cuts, to keep the tenons uniform in thickness throughout.



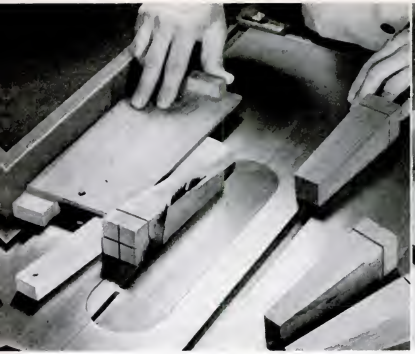


9 WITH THIS ADJUSTABLE JIG, you can turn out identical tapered parts. Lay the stock in the L-shaped runner, which is pivoted at its forward end. Align the bevel marks with the crosscut guide groove and anchor the runner at the correct angle with a nail; then adjust the

11 CIRCULAR SAW, without attachments, shapes large convex moldings. Glue a cardboard pattern to the end of the strip and make a series of bevel cuts to rough out the contour (note the use of hold-down blocks on the fence). Then sand the strips to a smooth finish.

12 TO RABBET MOLDING STRIPS, adjust the rip fence for one set of cuts, then reset it for the second. Go a fraction of an inch deeper than the rabbet with one pass to clean out corners. The notches also act as glue grooves for permanent panel inserts.

13 A MOLDING HEAD can turn your circular saw into a handy shaper. But the right bench setup is important to prevent weaving and fuzzy cuts. Here an auxiliary fence eliminates side play as the edge of a table top is guided over the cutter bits.



rip fence so the jig will push the stock through the saw along the bevel line (use a hold-down block when making the cut). Run off two adjacent—not opposite—sides with one jig setting. Then re-set the L-shaped runner for the third and fourth cuts.

10 FOR AN EIGHT-SIDED TAPER, replace the L-shaped runner with a V-grooved strip to make the last four cuts. Nail a short dowel or a block of wood near the end of the groove to back up the work. Here, one runner setting takes care of all four corner cuts.

14 WHEN LINING UP duplicate frame sides for mitered cuts, advance the work to a wood block butted against the rip fence, and clamp it to the crosscut guide. Butting stock directly against the fence may cause scrap to bind between the saw and the fence. END

Copper-Wire Craftwork Helps Decorate a Home

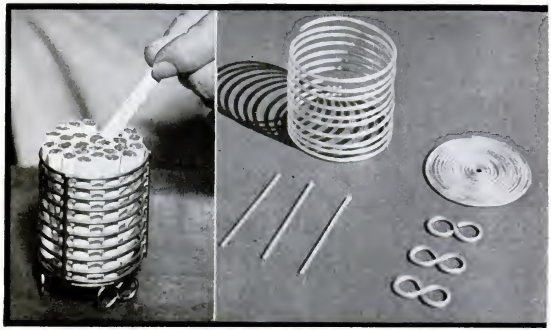
THE kind of copper wire that carries current through the walls of your home can be used to form many decorative articles. Here are four.

Use 12-gauge, single-strand wire, which you can buy for less than three cents a foot, and strip off the insulation. The soft copper is easily bent by hand, but becomes quite rigid when formed into shapes. The only tools you'll need are a soldering iron for joining and long-nosed pliers for bending tight turns and cutting the wire.

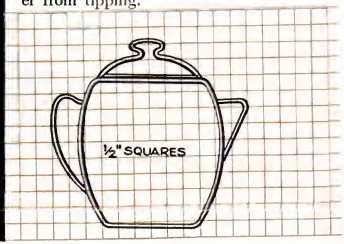
For a bright copper finish, mix bronzing powder with bronzing liquid and brush it on; for a dull finish, mix the powder with clear bronzing lacquer.—*Clifton Morris, Albuquerque, N.M.*

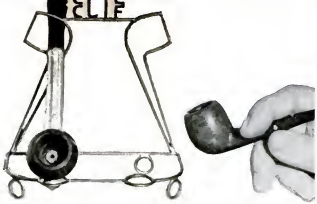
1 Cigarette holder calls for a single coil of copper wire for the sides. Wind the coil around a 2"-diameter can, pipe or other form, and then stretch it out to 2½" high.

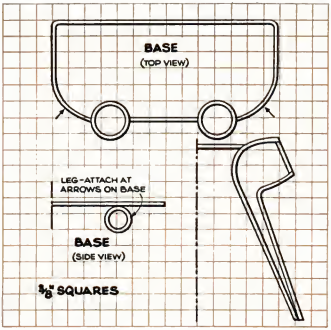
Wind another coil flat for the bottom and solder it on. Solder three upright wires to the sides to space the rings apart and three figure-eight feet to the bottom.



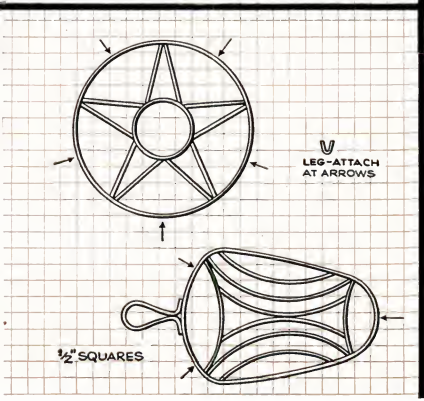
2 Napkin holder keeps the table neat and adds a decorative touch. The sides, two identical teapot outlines, are soldered to a 1"-by-6" rectangular base. Feet 2½" long keep the holder from tipping.



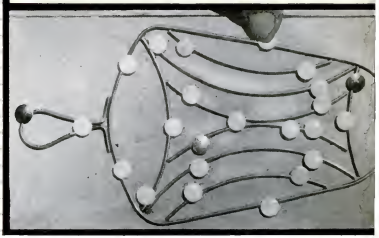




3 **This pipe rack** can be personalized by adding a name or initials to the cross-bar. Lay out the base and upright as separate pieces, and solder them together. The letters are 3/8" high, made from the same wire but painted black.



4 **Decorative trivets** for wall or table are easy to make for your wife. Lay out the parts of the pattern flat, join them, and then add the legs later. Scale up the designs and thumbtack the wires to a board for soldering.



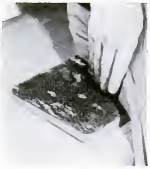
Jigsaw Shapes Linoleum for Fit

SLITS, curves and tricky shapes can be jigsawed easily in linoleum. The saw cuts intricate fittings better than a linoleum knife, and is less likely to slip.—*Frank A. Javor, North Bergen, N. J.*

Squeeze Bottle Squirts Cleaner

A PLASTIC hand-lotion bottle filled with paint thinner is good for cleaning hands and scrubbing up paint spots. Remove the dispenser plug and drill a hole in the screw cap.—*J. W. Rocke, Atkinson, Nebr.*

Pad Will Ease Grandstand Ache



NEXT time you have a date to see a game, take along a foam-rubber seat or kneeling pad. Put it on the wood or concrete seat, and even an overtime game won't cause any pain. Slipcover adds swank.

Contact Cement Gives New Backbone to Badly Worn Books

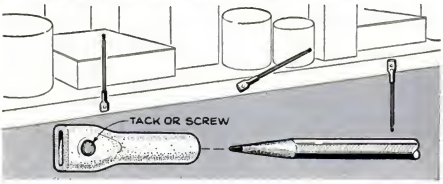
A BOOK with a torn muslin hinge can be repaired with contact cement.

First remove any loose paper and spread adhesive at the tear. Then close the book, after putting wax paper over the end sheet to keep cement off it. Indent the outside of the spine crease by running the handle of a pair of scissors firmly along its length. A heavy rubber band in the crease clamps it until dry.—*Ken Murray, Colon, Mich.*

Rubber Tubing Holds Pencil Anywhere: Workbench, Wall or Shelf

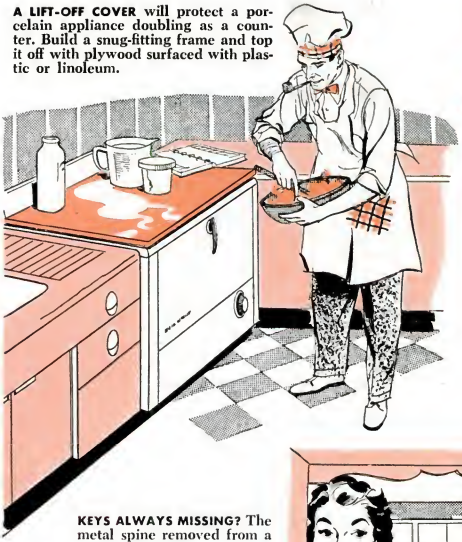
A PIECE of soft-rubber tubing tacked or screwed to a wall, shelf or workbench makes a convenient pencil holder that takes little space.

Simply stick the pencil poin' in; the soft rubber grips it firmly in any position you desire.—*George Walton, Sharonville, Ohio.*



KEEPING THE *Home* SHIPSHAPE

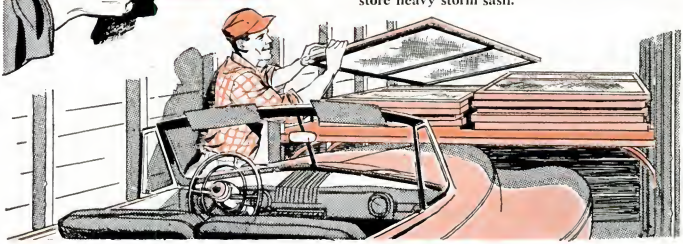
A LIFT-OFF COVER will protect a porcelain appliance doubling as a counter. Build a snug-fitting frame and top it off with plywood surfaced with plastic or linoleum.



MAKE A LAZY SUSAN for spice cans by nailing a tin pie plate to a cupboard shelf handy to the stove or mixing center. A touch of the finger will make the tray spin freely if you stack two metal washers between pan and wood.

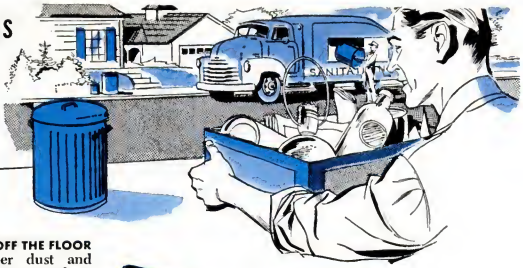
KEYS ALWAYS MISSING? The metal spine removed from a beat-up loose-leaf notebook makes a dandy key rack when screwed to a closet door. Gummed labels stuck to the metal rod will make it easy to identify each key.

TO STORE SCREENS IN THE GARAGE, build a shelf at the rear high enough to clear the car hood. Nail two-by-fours to studs and end cleats, and floor with slats or plywood. Add braces to store heavy storm sash.



Please turn the page for more home tips

More Home Tips

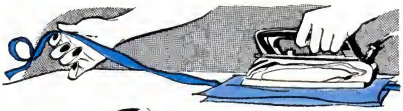


DE-JUNK YOUR HOUSE by using a 20-gal. garbage can. Every pickup day, add one piece of junk to the load. After you clear out all the old rubbish, your oversize can will keep new piles from accumulating.

TO KEEP RUBBERS OFF THE FLOOR where they gather dust and clutter up the closet, store them in one of the tiny clothes hampers that are made to hang on a closet door.

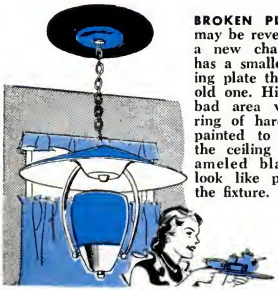
TOO MANY HATS for the closet shelf? Ask your men's shop for a few cardboard dividers, or make your own from the cardboard the laundry puts in shirts.

A LIMP TAPE MEASURE will take on new life if placed between sheets of waxed paper and pressed lightly with a hot iron.



STEEL WOOL WON'T RUST so readily if you park the damp pad on a glass flower holder set in a bowl. Water drains off through the holes, and the pad dries faster.

BROKEN PLASTER may be revealed if a new chandelier has a smaller ceiling plate than the old one. Hide the bad area with a ring of hardboard painted to match the ceiling or enameled black to look like part of the fixture.



1 FRAME THE OPENING with two-by-fours to make it plumb and square. This porch was to become a dining room, so I set another two-by-four at table height.

2 SQUARE STRIPS of ¾" lumber go all around, flush with outside of framing. In conventional job, these would be stops. Ventilating louvers go under windows.

How to Glaze Without Climbing

IF IT makes you feel unlucky to stroll under a ladder, just try strolling *up* one with a big pane of glass. I did it once, and that's why I worked out a way to avoid doing it again.

You see, I had a window wall to build at a point several yards above the ground, much too high to reach from outside without a lad-

3 GUN FILLED WITH GLAZING COMPOUND makes much faster job than knife and putty. A bead of compound goes all around against the stop after wood has been primed.

4 IN GOES THE GLASS, while I stand easily on a solid floor, not poised uncertainly on a ladder. Ordinary double-strength window glass does nicely for panes this size.

5 GENTLE HAND PRESSURE forces glass against glazing compound so that it fills space between glass and stop. Putty outside glass makes window extra weatherproof.

6 REST OF FRAME goes in as if it were the stop, completing reverse job. It is ¾" thick, wide enough to reach from glass to inner framing edge. Put in tops, bottoms first.

der. My solution to the problem has several advantages; and it applies to many situations encountered in glassing-in a porch with fixed windows, such as presence of trees or shrubbery that make it tough to handle glass from outside.

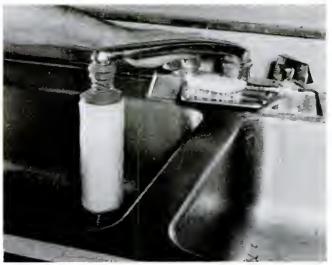
I began with the glazing method sometimes called back-putty-and-stop. This is much superior to the usual method and should be first choice for the do-it-yourselfer, even though professionals use it only for important jobs since it takes a bit more time. I simply worked the method backwards, so that I could install the glass from inside. The photos show the steps.—*Paul Corey.*

New for the Handy Man

1. Hood Telescopes to Fit Stove. With two ends that slide in or out of a middle section, this stove hood can stretch to fit any space between 30″ and 50″. The Cordion hood comes in two depths—12¾″ (to match most wood cabinets) and 13″ (for metal cabinets). It has a 4″ lip that tapers out 45°. Openings for ventilating ducts can be cut in the top or rear overhang.

2. Wires Plug into Outlet. Just poke bare wire tips into the holes on the back of this outlet, and it's ready to go into the wall. Spring contacts clamp the wires tightly so there's no need to fuss with wire loops or terminal screws. Pushing a nail into another hole spreads the bronze contact strips and releases the wires. The double outlet comes in brown or ivory and is approved by Underwriters' Laboratories.

3. Faucet Plug Washes Roller. Seat a paint roller on the plug end of this Rollr Kleenr and push the unit onto a faucet. A stream directed through and around the nap will wash out water-thinned paints.

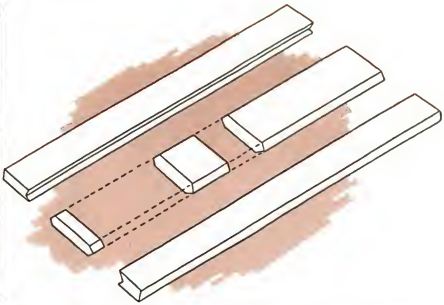


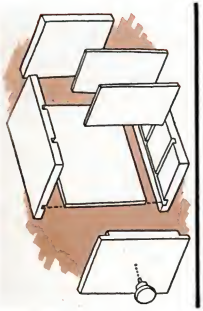
4. Stakes Screw into Ground. Strong winds will find it tough toppling a tree guyed to these stakes. Slip a rod through the eye and turn the self-anchoring auger tip into the soil. The removable earth gripper is fine for staking tents and boats as well as for permanently guying trees, antenna masts and the like. The Keep-Stake comes in three sizes with capacities up to 2,500 pounds.

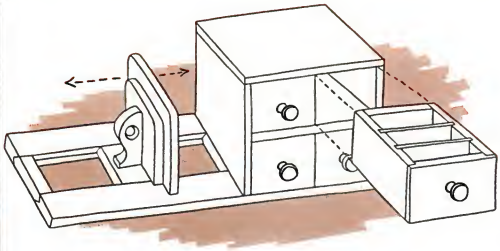
Further information on the products shown on this page can be obtained from: 1. Metal Units Co., Inc., 103 Park Ave., NYC; 2. Pass & Seymour, Inc., Solvay Station, Syracuse, N.Y.; 3. William F. Lewis, 166 N. Ridgeland Ave., Oak Park, Ill.; 4. A. B. Chance Co., 210 N. Allen St., Centralia, Mo.

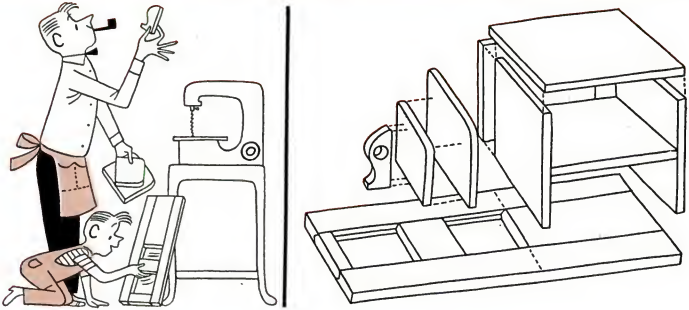
By Roy Doty and Dick Hutchinson

Wordless Workshop









Next Month: A door that lets in pets but keeps out wind and rain

PLAYTIME FURNITURE GOES MODERN. Juvenile chairs and table above are half the size of the adult originals. Small chairs are strung with cord like the large one in background.

THE DESIGN of the chairs and table was borrowed from the iron chair and ottoman below. The small furniture is built of wood, and wood top replaces cord for child's table (right).

A famous designer shows how you can build

Modern Furniture for the Youngsters

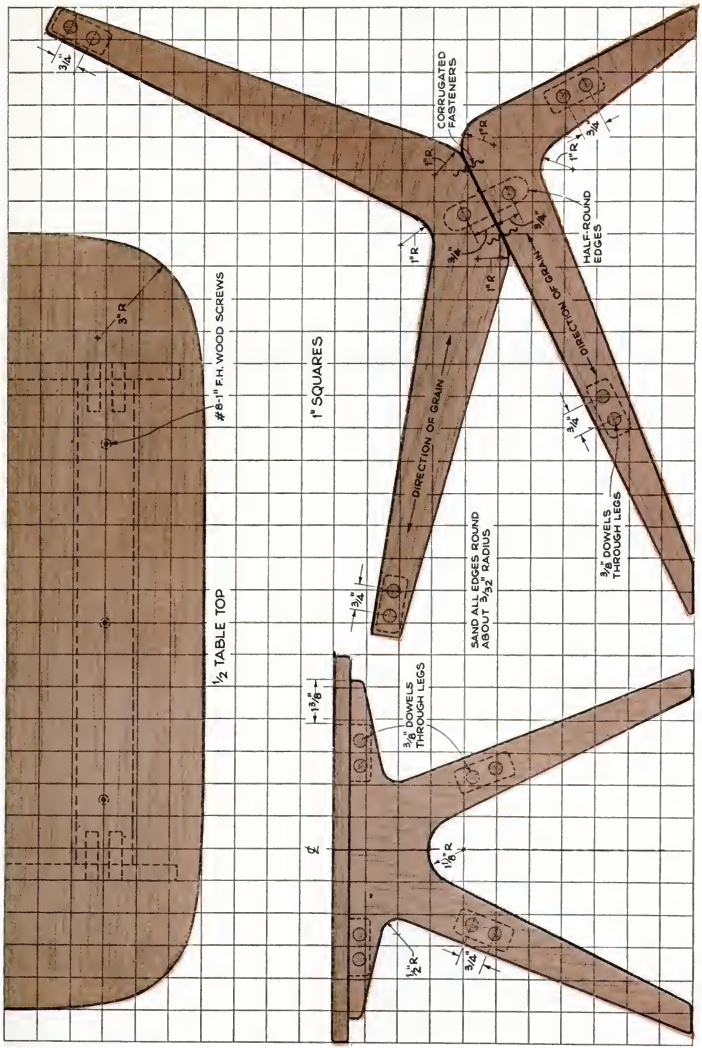
CHILDREN love to mimic grownups. So they are sure to welcome this modern play furniture—two chairs and matching table that look exactly like pieces the grownups might buy. The only difference is they are half size.

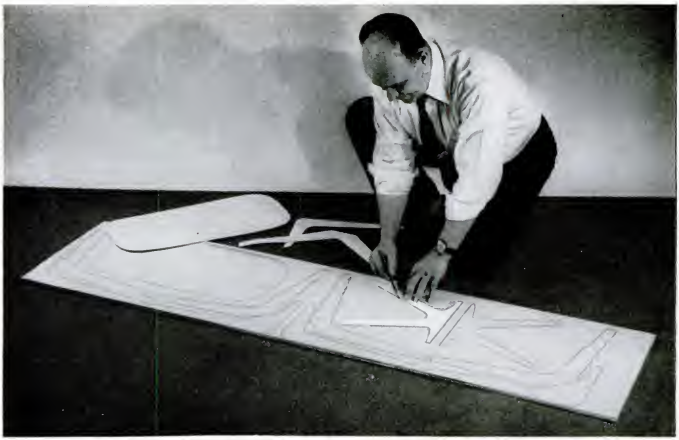
The little chair and table were designed by Allan Gould, who turns out a popular line of modern furniture for adults in his New York shop. The grownup furniture has metal frames. The scaled-down stuff was adapted for wood to make reproduction easier in a home shop with hand tools. The chairs are laced with Venetian-blind cord.

Because the parts are small, scrap pieces of plywood might be used if they happen to be available. Smooth gum plywood used in the examples pictured made it easier to apply the finish. But fir plywood could be used if sanded well. A flat-black finish with a protective coat of clear varnish makes a good-looking professional job.

About 190′ of Venetian-blind cord is required to string each chair. This costs around two cents a foot. You might also use plastic cord if it is available. This is more costly, but it can be washed with soap and water to remove hand prints.

For how to build the chair and table, see the next three pages


3/4"
3" R
#8-1" F.H. WOOD SCREWS
1/2 TABLE TOP
1" SQUARES
1" R
3/4"
DIRECTION OF GRAIN
CORRUGATED FASTENERS
1" R
3/4"
1" R
DIRECTION OF GRAIN
1" R
3/4"
HALF-ROUND EDGES
3/4"
3/8" DOWELS THROUGH LEGS
SAND ALL EDGES ROUND ABOUT 3/32" RADIUS
1 3/8"
3/8" DOWELS THROUGH LEGS
1 1/8" R
1/2" R
3/4"



CARDBOARD PATTERNS, made full size from the outlines on the facing page, enable you to lay out the parts with ease. All pieces for two chairs and a table can be marked out (above) on a plywood strip 18" wide ripped from a 4'-by-6' panel. A 3'-by-3' square will also do.

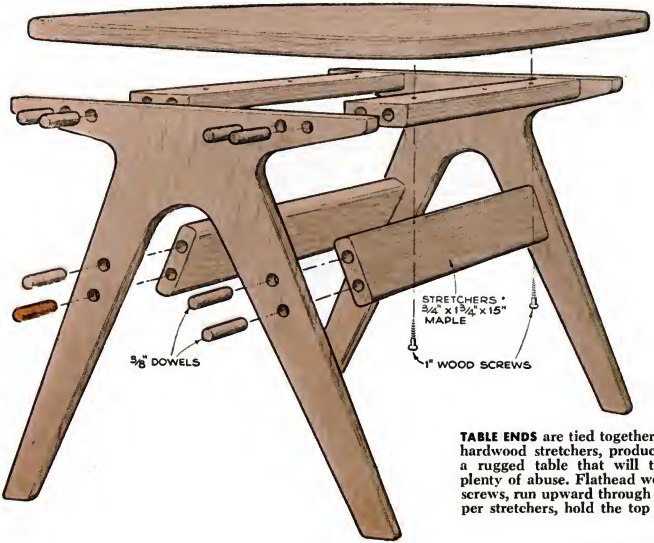
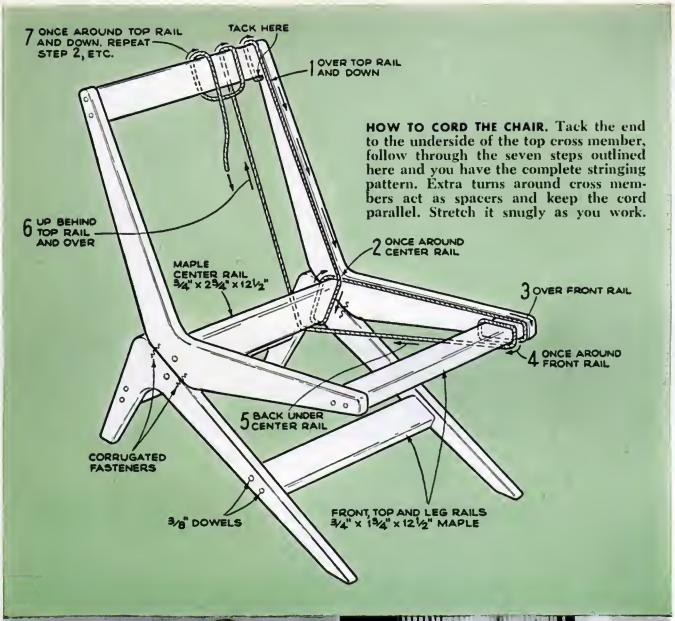


TABLE ENDS are tied together by hardwood stretchers, producing a rugged table that will take plenty of abuse. Flathead wood screws, run upward through upper stretchers, hold the top on.



HOW TO CORD THE CHAIR. Tack the end to the underside of the top cross member, follow through the seven steps outlined here and you have the complete stringing pattern. Extra turns around cross members act as spacers and keep the cord parallel. Stretch it snugly as you work.

IF THE COIL BECOMES TANGLED while you are doing the stringing job, clamp the last turn to the chair in order to keep everything tight while you are working out the snarls.

HIDE KNOTS by tying so they fall against the forward face of the rear seat rail. Make them at the point where the cord is looped downward around rail. Use square knots.

ROLL OUT A SHEET of this tan paper (left) and you have a quick rain cover for outdoor furniture. You'll find this and other papers in handy assortments, as pictured below.

Now Building Papers Are Jacks-of-All-Jobs

By Darrell Huff

MAYBE you'd like to tar-paper a playhouse roof, then you discover that the smallest amount you can buy would roof your whole home. So perhaps you figure that you don't really need the tar paper anyway. Let it leak.

Here's news. Now you can buy tar paper and other special building papers in small, home-size rolls—almost like kitchen towels or wax paper—for from less than $1 to about $3. These new rolls* are 36″ wide and contain from 100 to 250 square feet—instead of the 500 to 1,000 square feet you used to have to buy.

Besides using these building papers for building, you'll be surprised at the many other jobs you can do with them. Four of the most popular papers are

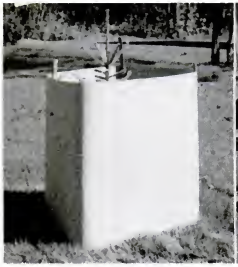
These papers are now available at many hardware stores, lumberyards, and building-supply houses.

already on the market in the new handy sizes. Here's what they are:

Red rosin is the familiar pinkish paper that you've seen protecting floors in new homes. It can do the same for you during temporary repairs or remodeling, or when the rainy-day shut-ins insist on riding their tricycles around the living-room carpet. It's the weakest of the lot, but at about 90 cents a roll is cheap enough to use once or twice and throw away.

Black sheathing is the asphalt-impregnated paper commonly called tar paper. It resists water, stands up under hard weathering, and should be used in all roofing or wall-sheathing jobs. The asphalt in it makes it particularly rot-

Tan reinforced paper is tough and waterproof



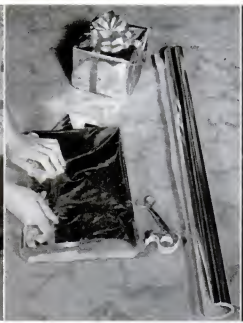
PROTECT TENDER PLANTS with a windbreak and sunshade like this. You can wrap power tools for moistureproof storage by double-folding seams and sealing with waterproof tape.

KEEP WIND AND WEATHER out of a vacation cabin by tacking strips to studs. Use them also to convert a screen door to a storm door, to mend a broken window, and as a tarpaulin.

ROLL-UP TENT for play or camping is made by hanging two or three widths over a clothesline. Reinforce edges by folding over and taping a cord into the fold, so stakes won't tear out.

Aluminum foil prevents heat loss and looks attractive, too

TACK FOIL behind a heater or radiator and it will reflect more warmth into your room and also shield the wall from heat damage. The foil is backed with a vapor-barrier paper.



HANDSOME GIFT WRAPPINGS are easily made (even if your wife sticks you with the job) by turning the shiny foil side out. The tough backing will defy even rough postal handling.

SLIP A SHEET under your wife's ironing-board cover and the reflected heat will speed up her work. Tacked up under garage or cellar joists, it insulates and makes an attractive ceiling.

resistant for uses below the ground or in contact with moist earth. You can buy a 100-square-foot roll for about $1.15.

Aluminum foil is essentially an insulation material, but reflects light as well as heat, brightening up many dingy spots such as attics, cellars and garages. Its silvery surface makes a good-looking wall or ceiling covering in itself and will cork up any heat leaks that are making your fuel bills seem like a statement of the national debt. It's about $2.65 a roll.

Tan reinforced paper is waterproof, weatherproof and the toughest of them all. It will cover a boat, keep outdoor materials dry all winter long, and seal the wind out of a summer shack. A roll costs about $2.05.

Black sheathing paper sheds water, won't rot in ground

LINERS for poultry houses, bird cages and pet boxes are quickly rolled in place, stay flat by their own weight and are cheap enough to permit frequent disposal and replacement.

CONES OF TAR PAPER wrapped around young trees and tied protect their trunks against vermin. Since the paper "breathes," it does not entirely shut out air and moisture vapor.

PLANT BOXES WON'T ROT if you line them this way. Paper laid over beds will also discourage weeds, protect plants through winter. Cover foundation if you bank earth against it.

Red rosin paper is least expensive, does many temporary jobs

DISPOSABLE DROPCLOTH to catch paint or cleaning drips stays in place better than newspapers, can be rolled up for re-use several times. Slip it under plumbing during repairs.

LINE SHELVES with this clean, non-staining paper or wrap blankets and clothes for storage. It will also keep your workbench neat during messy jobs, make cellar floors less dusty.

HIGHLY ABSORBENT, this is a natural for under-car repairs to keep a garage floor clean. Carry a roll in the trunk, too, for fixing a flat or putting on chains in mud or snow. END

Ingenious Hoosiers Are

And you, too, could prefab a home in your garage, says this father-son team that keeps on working regardless of weather.

By John L. Springer

HOW would you like to start building your house this winter, just working evenings? Despite zero temperatures and raging snowstorms, you could do it easily, comfortably and efficiently.

Charles and Richard Mickle, a progressive father-and-son building team of Lafayette, Ind., have built many houses under similar conditions in the last five years. They say even an amateur using their system could build faster and better than by conventional methods.

THE MOST IMPORTANT STEP in prefabbing a house is checking measurements, says Charles A. Mickle, who is shown with his son Richard going over the plans for a home.

The explanation? They build under shelter, where they control both light and weather. They are prefabricators. They assemble wall sections, roof trusses, door and window sections in a Quonset hut. When they complete the basic framing of the house indoors, they truck the assembled units to the building site and erect the entire shell, including doors and windows, within a day.

The Mickles have built 79 houses in five years—enough to prove that their system works. Yet their average production per year is low enough to class them as small builders.

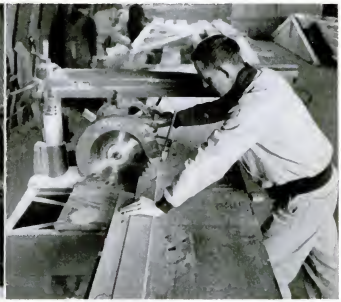
"Our operation proves that even an individual, building one home, can prefabricate it successfully," says Richard Mickle, 29, junior member of the firm. "You could assemble and store all the parts for a house in the average one-car garage."

Five houses at a time. The Mickles' Quonset, originally a farm-implement building, measures 40-by-80 feet. Within that space, they can produce the prefab parts of five houses at a time. Their basic power equipment consists of one fixed

Out of a Quonset hut came this $30,000 modern home. Richard Mickle built it for himself.

Building Houses Indoors

IN ONE PILE are all the panels needed for the exterior walls of a single-story house 32 feet wide and 24 feet deep. They represent the work of one man for a 48-hour week.



THE ONLY FIXED PIECE of shop equipment employed by the Mickles is this bench saw. They use it to cut all studs, joists and rafters prior to the actual prefabbing job.

ROOF TRUSSES, 24-feet long, are assembled in the Quonset hut. Use of a truss, so light that it can be carried easily by one man, saves on lumber and speeds erection of a house.

DOORS ARE FRAMED and hung in the shop, and holes bored for the locks. In the assembled house, the frames are plumbed and nailed into place and the locks put in—a 20-minute job.

bench saw and a portable hand saw.

On one long table, they assemble exterior wall panels in four, eight, 12, 16, 20 and 24-foot lengths. They make frames for all windows and doors and nail ⅜-inch sheathing to the stud skeleton.

Height of the panels depends upon the finished room height. A panel eight feet high would provide for conventional finished ceiling height of eight feet ⅜ inch. Another 1⅝ inches is added when a long two-by-four is nailed across the top of the panels to tie them together.

For all walls, they use conventional two-by-four stud framing, 16 inches on centers, with two-by-four top and bottom plates. Interior partitions are framed in the shop, but the finished wall (plaster or

AT THE HOME SITE, a rough floor is laid over a concrete slab before the first panels go up. With no fitting or sawing necessary, the workday starts with raising and nailing panels.

THE HOUSE IS ENCLOSED by the end of the day, and all windows and doors are installed. Plumbing stack and flashing are in, too, and the roof is ready for asphalt shingles.

½-inch gypsum wallboard) is applied on the job after the shell has been erected.

Roof truss helps. For most houses the Mickles use a new type of roof truss developed by the University of Illinois Small Homes Council. Fabricated in the hut, it is made of two-by-fours glued and nailed. They fabricate the trusses after they complete the wall panels, because they can use many two-by-four and plywood scraps in their construction.

Trusses are designed to be spaced 24 inches on center, and covered with ½-inch sheathing.

When all the panels are assembled, ready for delivery to the building site, the package is like one you get if you buy a prefab house.

Richard Mickle says his method offers three advantages:

• It prevents delays. Conventional builders can work only in daylight and in warm, dry weather. Prefabricating enables you to work day and night in a light, warm, dry place. It takes only one day to move work from the shop to inside the house.

• You can work more efficiently. Inside you don't lose time trying to keep warm, for instance. A power tool is at your side—you don't have to string long lines to distant light poles for juice. You can lay out work so that you do all heavy nailing down, from waist level.

• There's virtually no waste. Conventional carpenters will saw a large piece of lumber rather than climb down from a scaffold to find a small piece. In the shop, the Mickles can use almost every scrap.

I watched them and their crew fabricating panels for a one-story house 32 feet wide by 24 feet deep—with a total area of 768 square feet. Three men started working at 10 a.m. By 5 p.m. the next

[Continued on page 254]

Listening With Both Ears

What you should know about binaural sound

By Harry Walton and Hubert Luckett

EVEN with a high-fidelity system, the chances are you've never heard recorded or radio music with both ears.

Sure, you've listened with both. But what you heard was monaural sound—you could get as much from it with one ear as with both. *Binaural* reproduction is as startlingly different as a 3-D photo is from an ordinary one, and for somewhat the same reasons.

Stereo cameras take two pictures from points a few inches apart, the way your two eyes see things. These two different images are blended into one of apparently three dimensions. But two *identical* pictures, even if seen through a stereo viewer, would look as flat as a single one. It is pretty much the same with sound.

You hear double. Normal hearing is binaural; each ear hears from a slightly different distance and direction. Most people are unconscious of this difference, but it gives depth and reality to sound, as dual seeing does to vision.

So why not use two speakers? Dual speakers can help round out sound by giving the illusion that it comes from two directions. But it's still monaural—an imitation, not a reproduction, of reality.

True binaural sound can make you

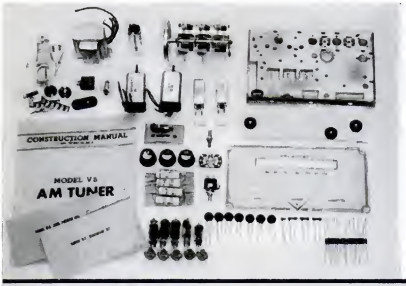
jump. One hi-fi enthusiast, invited to hear a binaural tape with earphones, inadvertently put them on backwards. When the music started, he spun around to look for the orchestra *behind* him.

It takes two tracks. Three-D sound must start with two microphones set up a few feet apart. Their outputs must be kept separate all the way to your living room. For recording, each mike must feed its own recording head; two tapes, two edges of a single tape, or two grooves on a transcription disk must be recorded simultaneously.

For broadcasting, one mike goes to an AM and the other to an FM transmitter. (They could as well feed two AM transmitters working on different frequencies, but our stations aren't licensed for that, whereas more than 490 of them now transmit AM and FM simultaneously.)

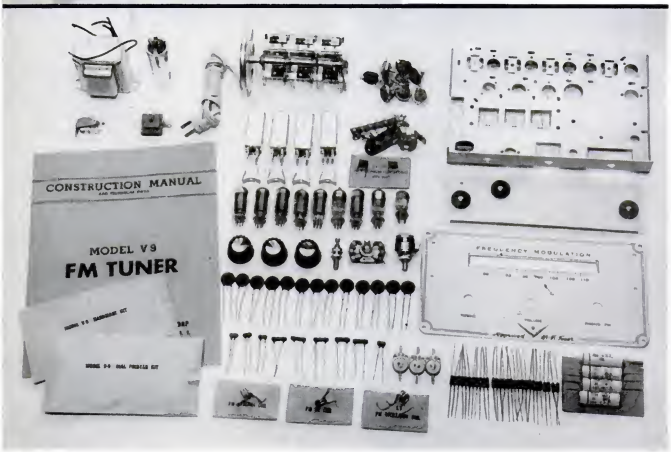
What you receive from such a station by using two sets is *not* binaural unless the station is transmitting from separate microphones or a binaural recording. At present New York, Boston and Chicago offer weekly binaural broadcasts, and other cities occasional ones.

How to receive them. If a station in your area puts out such programs, you



Twin AM-FM kits are designed for binaural

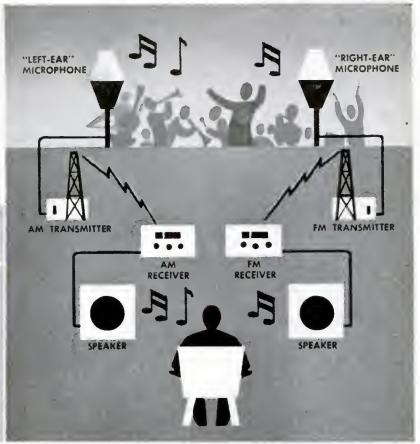
MEANT FOR EACH OTHER, these tuner kits can get binaural at its best. AM set is a 5-tube superhet with tuned RF stage. FM rig has 9 tubes, tuned RF stage, linear response, and extremely low noise level, due largely to a true Armstrong detector circuit. With no antenna whatsoever, the set PSM assembled pulled in stations well even in a steel building notorious for bad reception. It showed no perceptible drift. Cathode-follower outputs in both sets permit long lead to amplifier without loss of highs.



 Above kits available from Approved Electronic Instrument Corp., 928 Broadway, New York 10, N.Y.

Two-channel listening gives sound three-dimensional perspective

SPOT YOUR SPEAKERS at one end of the room. Some prefer to place them facing the listener, as in the drawing at right, but many enthusiasts prefer to aim them into the corners as shown below. This bounce placing may lose a few high frequencies, but minimizes some random distortion and affords a larger zone of good binaural listening. Distance between speakers is a matter of experiment; best spacing depends on size of room, arrangement of drapes.



can get them by putting an AM and an FM set in the same room. Place them 6′ to 10′ apart along one of the shorter walls. To find which goes where, better telephone the station beforehand. Binaural is still so new that no standard has been set.

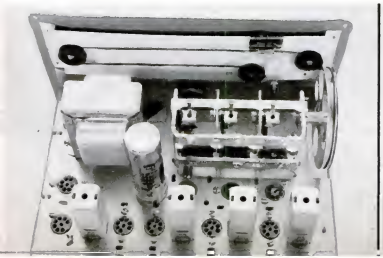
Even with ordinary receivers, the magic of binaural sound will be evident. If one is a hi-fi set, all the better. If both, what more could you ask?

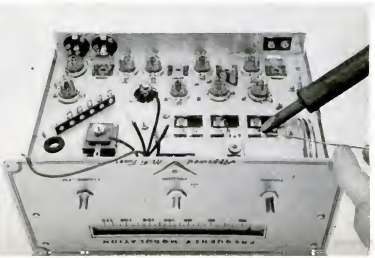
Twin tuner kit. At least one manufacturer now offers kits for "binaural twins" —AM and FM tuners designed to work together. They require separate amplifiers and speakers, of course. You could use a phonograph amplifier for one, and the phono input of your TV set (if it has one) for the other. The kit for the AM tuner is $24.50; for the FM tuner, $29.50. If you prefer to duck construction, you can get the sets wired, aligned and ready to play for $28.75 and $37 respectively. Both are of hi-fi caliber, and of course either one can be used alone for good monaural reception.

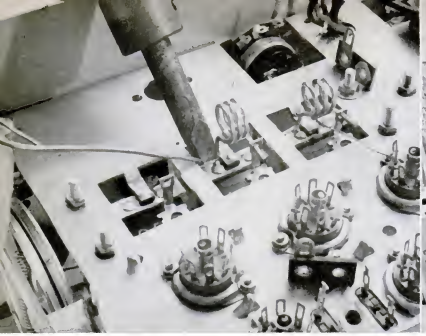
Construction of the tuner kits is not difficult. The step-by-step instructions

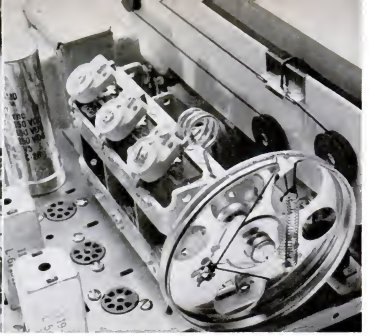
Prepunched chassis makes it easy to mount the parts

IT TAKES AN HOUR for the average builder to mount FM tuner parts on the chassis like this, ready for wiring in the smaller components. An important step is grounding all three sections of the tuning condenser. Solder them to the tabs punched out of the chassis, using at least a 100-watt iron (below right) so that solder flows freely, forms a good bond.









High-frequency coils are mounted directly on tuning condenser

FM TUNING COILS, which have only three turns, are mounted directly on the tuning condenser. One end of mixer coil (near iron at left above) and of oscillator coil to right of it is soldered directly to condenser frame below the chassis; other ends go to stator lugs, which project through chassis cutouts. The RF coil is mounted on top of the condenser (above right) and so is shielded from the others by the chassis. Trimmer condensers (in row below RF coil) also are soldered to the frame of the tuning condenser and to its stator lugs.

provided enable anyone who has done any radio wiring to build them. Alignment requires some test equipment and a little know-how, but both are available at any radio-service shop.

Tape goes binaural. Some medical schools have found binaural tape recordings of heart sounds a great improvement over stethoscope listening. Besides affording a permanent record, the tape is said to permit more accurate analysis of heart irregularities.

Pre-recorded binaural tape is available, but you can't play it on an ordinary tape machine. Dual heads are necessary to pick up from both edges of the tape.

Rolling your own. With two tape recorders, you can experiment with binaural recordings yourself. (Disk recording isn't practical because it's almost impossible to synchronize the two platters.)

One of your recorders must have removable pole pieces. Carefully detach these from both the recording and erase heads, and put them back upside down on one machine. Place the two recorders so that they touch and the tape will feed in the same direction through both (one can be turned around if necessary).

Mount the full spool on the feed reel of one recorder and the empty one on the take-up spindle of the other. Remove the capstan pressure roller from the first so that the capstan of the second one pulls the tape through both heads.

Set the two mikes about 7′ apart, turn both recorders to the same speed and volume setting, and try taping conversation between two or more persons, the voice of someone walking about the room, the sounds of a model railroad, or your neighborhood string quartet.

Synchronization may slip a bit if the machines shift out of position or the tape stretches because of humidity, but you'll get binaural reproduction.

Keep your ears sorted! To play back, the machines must be in exactly the same position as for recording. You can use the built-in speaker of one, but will have to run the output of the other to a separate speaker a few feet to the other side.

Earphones are even better. Plug a set into each machine, but interchange one receiver from each as shown in the drawing on the facing page. Two can listen by putting their heads together.

The last word? Earphones afford the ultimate in binaural reproduction, because they channel what each ear should

WIRED UP, the FM tuner looks like this from beneath. Small condensers and resistors are mounted close to the chassis and in as direct line as possible to keep their leads short.

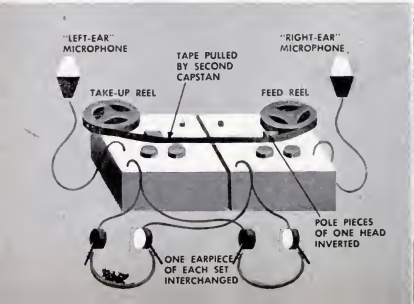
hear to it alone. Real-gone audiophiles claim that two speakers don't provide simon-pure binaural sound, because the opposite ear hears some of what's meant for the other. Turning the sound loose in the air may also cause minor distortion because of differences in phase and path lengths.

For these reasons, some purists prefer to call dual-speaker sound stereophonic rather than binaural. But whatever you name it, it's the most yet. END

Tape and LP disks may bring binaural sound to the home

YOU CAN TAPE YOUR OWN binaural sound with two recorders, provided one has reversible record and erase heads. Alignment of machines must be exactly the same for playback.

BINAURAL RECORDS have the two tracks one inside the other, are played by dual-head tone arm. An LP disk of the type shown below gives 12 to 15 minutes of playing time.



Five Darkroom Tips

1 AGITATION OF THE DEVELOPER while you are turning prints is easy with an electric fan close by. But you'd better turn the fan off while you're using the enlarger. The vibration may affect sharpness.

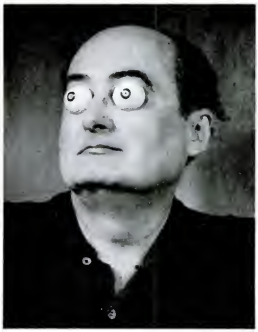
2 HANDLE NEGS with dry tongs if you use a glassless holder. This will keep negatives free of moisture from the hands and prevent curling which may put part of scene out of focus during exposure.

3 DUST ON GELATIN FILTERS used with variable-contrast papers, which you might scratch by wiping, is removed safely with a magnetized hard-rubber comb. Rub the comb briskly with silk and pass it closely over the filter.

4 A CELLULOSE SPONGE tends to release bits of cellulose on negatives after long use. This can be prevented by covering the sponge with a piece of flannel, placing the nap on the outside.

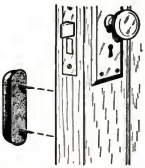
5 SET A TIMER in the dark by the sense of touch? You can do it by making these alterations: Drill holes in the timer body opposite the most-used time intervals and turn in self-tapping screws. Solder a fine wire to the pointer to help align it with the screw head marking the desired time interval.

Ping-pong Eyes Make a Scare-'em-Yourself Halloween



For Halloween, youngsters will have fun wearing these scary eyes. Erase the trademark on a Ping-pong ball and cut it in half. Then with a pen or crayon draw an iris on each and punch a small see-through hole. Rubber cement on the edges helps the shells stick.—*Ken Murray, Colon, Mich.*

Rubber Bumper Protects Paint Finish



Refrigerator or cabinet doors won't chip or dent if you stick a dime-store rubber bumper on any object it opens against—such as another door. An ideal bumper is one used on toilet seats. It's small and has a built-in tack that can be pressed into a door or wall.—*William A. Crane, Oklahoma City.*

DO IT THE EASY WAY

STEEL-WOOL SLIVERS caught in corners of a piece of furniture after it has been rubbed down are easily removed with a small magnet.

TWO COLORS WON'T RUN over each other if you score your layout with a razor blade before painting on wood. The razor makes a thin, invisible "ditch."

MUFFLE TYPEWRITER CLATTER by placing carpeting under the typewriter. Friction tape put on the carpet bottom will make it slip-proof.

TO START A NAIL in a narrow space, encase the tip in a blob of putty. It'll hold the nail and you won't skin your knuckles while you bang away.

Look what this man pulled out of a refrigerator . . .

Junked Compressor Runs as Steam Engine

By Capt. L. S. McCready, USMS

GOT a yen to build a husky little steam power plant, small enough to be fun, big enough to do real work? You'll find the makings, with the hard work all done, at a junk yard or refrigerator dealer's. Just buy yourself a small air or refrigerator compressor.

It puts out amps. I converted an old General Electric Freon compressor to drive a generator on the steam launch *Little Effie* (PSM, June '54, p. 124). Direct-coupled to an old Plymouth auto generator, it easily puts out 16 amp. Pushed a bit, it will deliver 30.

Look, no cranks! In this as in many compressors, the pistons are driven by eccentrics instead of cranks. There were loud cries of "won't work" when friends saw this. But it does; the shaft spins smoothly both at idling and high speeds.

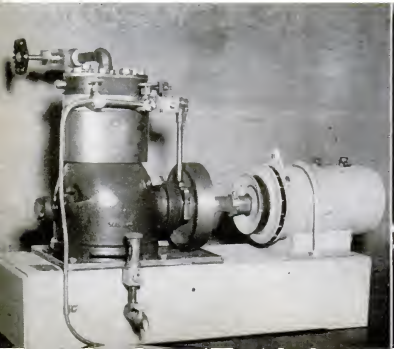
The compressor was dismantled and the parts cleaned. The Freon valve plate was discarded. (There were no valves in the piston heads; where these exist, they must be brazed or otherwise sealed shut.)

New head forms valve. A piece of ⅞"-thick cast iron, machined flat on both sides, was milled right through for steam ports that open into each cylinder. Between them is the exhaust port, milled only deep enough to communicate with a cross hole tapped for the exhaust pipe. To spot the bolt holes, the old head was used as a jig.

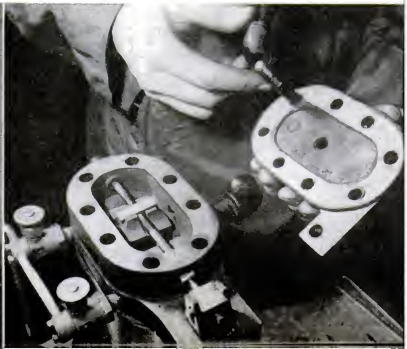
Eccentric works valve. For the steam chest, a second thick plate was cut out inside, fitted with a brass gland and a valve-stem guide, and drilled for the head bolts.

To drive the valve, an eccentric on the shaft actuates a bell crank. The slotted upper leg of this engages a cross pin set

NEW HEAD FOR OLD, plus a simple eccentric drive for the valve, makes a lively single-acting, two-cylinder, high-speed steam engine out of a GE-type CM302D compressor. The bore is 1½", the stroke 1⅜".



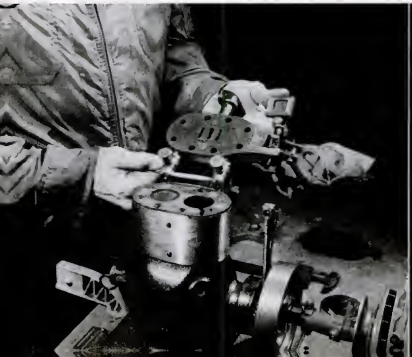
REMOVING STEAM-CHEST COVER reveals D valve, driven by a bar nut on the valve stem. The nut lies loosely in a slot, so that valve is held onto the port face only by steam pressure. Drain valves (left) connect directly with cylinders.

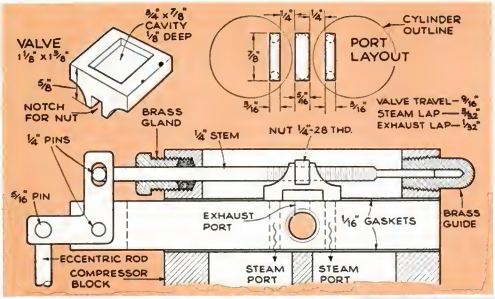


THROTTLE OPEN, this converted Freon compressor spins an old auto generator for outputs up to 30 amp. Although pistons are driven by eccentrics, these act just like oversize crankpins. The engine ticks over smoothly at a slow idle, or revs up to 2,300 r.p.m. without trouble.

NEW VALVE PLATE, here removed, was cut with a fork for the bell crank. This consists of two pieces, joined by a pivot bearing and a pin on which the eccentric rod works rather freely. Valve is shown in fingers, cavity up.

ECCENTRIC IS TURNED with a flange to hold the sheave. Bent tube alongside rod carries oil to the eccentric. A pipe nipple brazed into bottom of crankcase runs through an elbow to the oil-gauge glass and drain cock.





THE VALVE OVERLAPS both steam ports by 3/32" when centered. This makes for steam economy. Exhaust lap of 1/32" cushions pistons at top of stroke. Drill rows of holes if you can't mill slots.

THESE PARTS put steam where Freon went before. Underview of the head (below left) shows that only steam ports go through. D valve and steam chest are in center, the cover at right. Three gaskets are used.

into a block threaded on the valve stem.

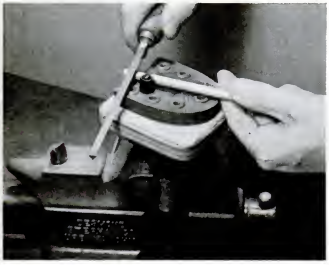
Valve is adjustable. By turning the stem in the valve nut, the valve can be adjusted to open both steam ports equally at opposite extremes of its travel. The eccentric is set to admit steam a few degrees before top dead center and close each port when its piston is little more than half down.

The finicky fittings. Drain valves, screwed into holes that connect with the cylinders, are for blowing off condensate when starting. A hole is drilled in the top half of the crankcase as a breather to prevent blow-by pressure from forcing out oil. The crankcase is filled with auto-engine oil; a gauge glass shows its level and condition. When cruising, we drain off condensed water once a day.

Since *Little Effie's* is a condensing plant, in which the exhaust is returned as water to the boiler, no lubrication is introduced into the steam line. The cast-iron valve works dry on the cast-iron port face. After much running, both promise to wear, properly enough, like iron.

This dry-running characteristic of cast iron works only with saturated (wet) steam. With superheated steam, or with steel or bronze valve parts, you'd need a lubricator in the steam line. END

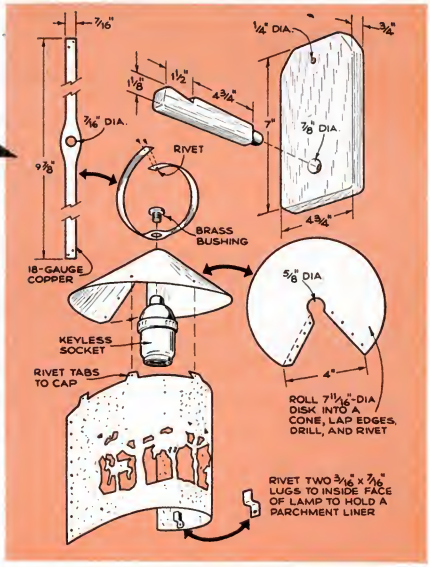
Rubber Heel on Wood Block Serves as Pad for Precision Filing



A RUBBER filing pad like this makes it easy to hold rods, strips and other work without danger of marring while you do a bit of precision filing. It can be used also as a soft anvil or fine-sawing support.

It consists of a rubber heel for a man's shoe nailed to a 3½"-by-3½" square of ¾" plywood. The work-holding post is a ½" piece of ½" rubber tubing held in place by a 1½"-8 roundhead wood screw. The unit is clamped in the vise by means of a 3½" length of ¾" pipe threaded into a floor flange screwed under the wood block.—*Walter E. Burton, Akron, Ohio*

Hunting-Scene Lamp for Your Den



WANT a novel wall lamp for your hunting lodge or den? You can make this one for pennies, using the tinned steel salvaged from a castoff two-gallon oil can.

Punch out the top and bottom of the can with a cold chisel. Then part the side wall along the seam with tin shears. Flatten the stock and draw the outline of the lamp body and its silhouette either on the metal or on thin paper glued to its face.

Cut along the outline with your tin shears, leaving four tabs on the upper edge so the lamp cap can be attached later. Punch out the design with a small, sharp cold chisel and smooth the rough edges with pattern files. While the stock is still flat, drill rivet holes in the tabs.

Roll the lamp body into a drum and, with a strip of wood projecting from a vise for a backing block, drill holes through the lapping edges for brass rivets. Insert the rivets from the inside. Back them up with a steel bar while you peen the heads.

Cut a disk for the lamp cap from another piece of can stock. Remove a wedge-shaped segment so you can bend it into a cone and file out a ⅜" hole at the center. Then draw the edges together for a riveted lap joint.

Holding the cap upside down, position the lamp body and bend the tabs

HUNTING-SCENE SILHOUETTE is punched out with a small, sharp cold chisel. Back the stock with a hardwood block.

12-INCH SLIP ROLLER curves the lamp body in a jiffy. Or you can roll the stock around a piece of large-diameter pipe.

DISK SHEAR cuts a perfect circle for the cap. But an old-fashioned pair of tin shears will do the job almost as well.

to contour. Drill mating rivet holes in the cap. Again, insert the rivets from the inside and peen the heads.

The handle is made of copper. Bore a 7/16″ hole through the center of the strip before shaping it into a ring and riveting the ends together. Pass a brass bushing through the hole in the handle, then down through the cap to a threaded connection with a keyless lamp socket.

To complete the metal work, rivet two lugs to the inner face of the lamp body near its base. These lugs hold a parchment insert after the lamp is completed.

Make the wall escutcheon and peg of hardwood. Use a natural wood finish to contrast with the lamp, which can either be painted with flat black enamel or given a dull-luster, antiqued metal finish.

For the latter, pass the flame of a blowtorch over the tinned stock, then rub down the metal with steel wool and apply floor wax to prevent rusting. Darken the handle by giving it a coat of copper nitrate solution (available at drugstores). After applying the solution, heat the metal until it turns brown, dust off and repeat. Then wax the ring and polish it. Don't let the acid come in contact with your hands or clothing.

Finally, wire the light socket and line the lamp body with parchment paper or thin watercolor paper painted with white shellac. Insert an orange-colored bulb and there you are.—*Dick Hutchinson, San Gabriel, Calif.*

CHAMPION SPARK PLUGS SCORE 16th

CONSECUTIVE GOLD CUP VICTORY!

The "Gold" Cup, most coveted trophy in American Hydroplane racing.

"We are thankful that we used Champions, the world's finest spark plugs, in our Gale V to win the Gold Cup." —Lee and Joe Schoenith

The sixteenth consecutive victory of a Champion equipped boat in the Gold Cup was preceded this year by Champion's twenty-fifth victory in the Indianapolis "500" and the winning of the Mobilgas Economy Run for the sixth straight year.

And to date in NASCAR Grand National competition 22 of 23 races have been won by Chrysler, Oldsmobile, Hudson, Chevrolet and Buick stock cars using Champions.

Any engine worth its gasoline deserves Champions. And now is a mighty good time to see your nearby Champion dealer and start getting all the performance you're paying for!

EXCLUSIVE S-RIBS MEAN QUICK STARTS

CHAMPION

When you buy a Signet Slide Projector you buy "*Screen Brilliance*"

You know that it takes a really superb optical system to make your favorite color slides "come to life" on the screen. Because we're especially proud of the optical system in our Kodaslide Signet line of 2 x 2 slide projectors, we'd like you to see what a Signet can do for *your* pet slides. Your dealer can show you Signets in the six different combinations of lenses, lamps, and slide changers shown below.

These are some of the special features you'll like when you evaluate a Signet by *your own senses* of sound, touch, and sight:

BY SOUND—Turn the master control switch to "blower" position. Hear that low whir? It's from an impeller-type blower that is channeling cool air over all the internal surfaces. But apart from its mechanical efficiency, the nice thing about this blower is its "shush." Won't compete with conversation or soft background music.

BY TOUCH—Snap the master control switch to its various positions. Rotate the lens barrel. Try the slide feeding action, the unique elevating mechanism. Notice how simply, how precisely, everything works? That's the secret of the Signet's exceptional handling ease.

BY SIGHT—With a slide in place, switch on the lamp and focus the lens. Notice that the images are crisp, sharp, and evenly lighted over the *entire* slide area. Above all, notice their brilliancy—even in the shadow areas. With a Signet, you can actually project a bright image in subdued room light.

Kodaslide Signet 300 Projector

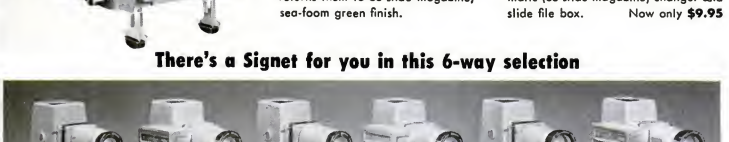
with automatic changer

only **$69.50**

Kodak Projection Ektonon 5-inch, f/3.5 lens; Lumenized optics; 300-watt lamp; impeller-type blower; 2-way switch; individual leg tilt; automatic changer centers slides, returns them to 36-slide magazine; sea-foam green finish.

Kodaslide Signet Projector Case holds projector with regular take-up changer, receiver and slide file box, or projector with automatic (36-slide magazine) changer and slide file box. Now only **$9.95**

There's a Signet for you in this 6-way selection



Signet 300 f/3.5 with take-up slide changer (otherwise same as described above), **$59.50**

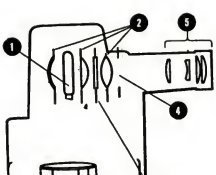
Signet 300 f/3.5 with automatic slide changer (see description above for details), **$69.50**

Signet 500 with 5-inch, f/3.5 lens; 500-watt lamp; same versatility as 300. Frosty beige, **$72.50**

Signet 500 f/3.5 with automatic slide changer (otherwise same as described at left), **$82.50**

Signet 500 with 5-inch, f/2.8 extra-fast lens; 500-watt lamp; regular take-up slide changer, **$79.50**

Signet 500 f/2.8 with automatic slide changer (otherwise same as described at left), **$89.50**



What makes a Signet stand out?

That's easy. Performance. The kind of big, brilliant screen results that give any slide fan a thrill of satisfaction.

What accounts for the Signet's ability to project a superior screen image? In the cross-sectional diagram of a Signet, above, you'll notice that a powerful projection lamp (1) has been aligned between a front-surfaced hemispherical mirror and two Lumenized (hard-coated) condensers. This snug arrangement (2) concentrates and beams an exceptionally strong shaft of light through the color slide.

Since all lamps radiate heat, Kodak engineers have given the Signet the finest of cooling systems. The combination of a panel of heat-absorbing glass and an impeller-type blower (3), plus internal air baffles, protect the Signet inside and out. The housing doesn't even become hot to the touch.

A good picture has to be a *steady* picture. The regular slide changer on a Signet permits slides to be fed in singly from the top (4). It's a fast, smooth method that never jars the projector. With an automatic changer, slides are fed into the projector in any sequence from a 36-slide magazine—again without jarring the screen image.

The edge-to-edge sharpness and color clarity of a Kodak Projection Ektanon Lens (5) speaks for itself the instant you project a slide in a living room, classroom or auditorium. Ask your dealer to show you a lens-lamp-changer combination to suit your needs.

Prices are list, include Federal Tax where applicable, and are subject to change without notice

Ask your dealer about small down payments and easy terms

Eastman Kodak Company
Rochester 4, N.Y.

CHECK THESE OUTSTANDING SIGNET FEATURES

Kodak
TRADE-MARK

KODASLIDE SIGNET 500	KODASLIDE SIGNET 300	FEATURE
X	X	**Projection Lens** —f/3.5, 5-inch Lumenized Kodak Projection Ektanon Lens
X		f/2.8, 5-inch Lumenized Kodak Projection Ektanon Lens
X	X	**Condenser System**—Two Lumenized close-coupled condenser lenses collect and deliver maximum light to slide; aluminized glass reflector
X		**Projection Lamp** —500-watt, medium prefocus base (also accepts 300- or 200-watt)
	X	300-watt, bayonet base
X	X	**Operation** —Automatic push-pull slide changer feeds slides in any sequence, skip or repeat, returns them to 36-slide magazine
X	X	Regular take-up slide changer stacks in sequence; accepts Kodaslide Box for group slide filing and storage
X	X	Takes single-frame stereo adapter
X	X	**Elevation** — Individually spring-loaded front legs for 0-12° elevation
X		Adjustable rear leveling leg
X	X	**Cooling** —Quiet, impeller-type blower gives full-pressure cooling; channels cool air over all internal surfaces
X	X	Aluminum heat-dissipating panels channel flow of air
X	X	Extra-thick heat-absorbing glass
X	X	**Construction** — Sturdy, die-cast aluminum housing
X		**Electrical System** —3-position switch permits blower to operate independently of lamp. Thus, blower can be left on to accelerate cooling after projection
	X	2-position switch. Blower and lamp operate together
	X	Operates on 105-125 volts, AC. Long 12-foot attachment cord facilitates electrical connection
X	X	**Styling and Finish** —Streamlined, functional design. All controls on right for convenience
X		Frosty beige finish
	X	Sea-foam green finish

Projection Throws

Long Dimension of Projected Picture	Distance from Projector Lens to Screen: 35mm slides	Distance from Projector Lens to Screen: 828 slides
30 inches	10 feet	8½ feet
40 inches	13 feet	11½ feet
4 feet	15½ feet	13½ feet
5 feet	19 feet	17 feet
6 feet	23 feet	20½ feet
7 feet	25½ feet	23 feet
8 feet	29 feet	26 feet
9 feet	32½ feet	29½ feet

Photo Print Washer You Can Make for $4

YOU'RE missing much of the fun in photography if you aren't doing your own darkroom work. Or if you're doing it with inadequate, improvised equipment.

I have a print washer that swirls the prints around like a store-bought one. It cost me only $4 to make. The tank is a galvanized oil-drain pan, available from auto-supply stores or through your local service station for about $1.50. Equipped with an inlet and outlet, it washes 10 to 20 8″-by-10″ prints in about half an hour.

My tank is 16″ in diameter, but you can get an oil-drain pan in sizes up to 24″. It should be at least 5″ deep and hold about three gallons of water for adequate capacity. A straight-sided oil pan makes it easy to wire on dowel legs, as I did. If you can't find one, you can

[Continued on page 244]

OUTLET DRAIN enters the tank bottom through a ½″ brass pipe elbow, clamped inside with a matching ½″-pipe flange. Drill a ¾″ hole with a fly cutter, punch or old wood bit. Screw garden hose to the elbow with an adapter that joins ½″-pipe threads to hose threads.

IT HAS VALVE CONTROL, TOO. By tipping up the drain tube, you can adjust the runoff flow and thus the tank's water level. Drill a hole in the rim, insert a coping saw, and cut a short slot outward. A ball-type key chain slipped into the slot locks the hose at any angle.

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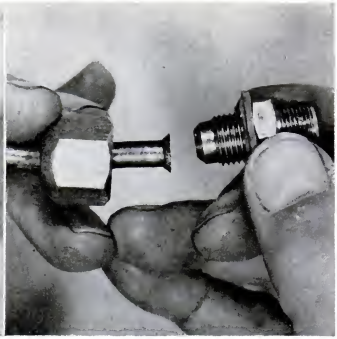
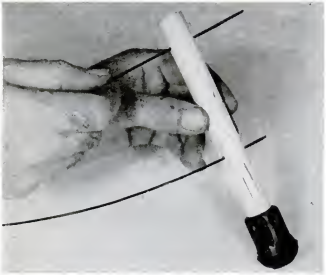


INLET PIPE is a 4" length of ¼" copper tubing connected by a flared union fitting (above right) to a 3' rubber slip-on hose that you can attach to any faucet (see page 242). Drill a ⅜" hole in the side of the tank and insert the union from outside, then clamp on the flared end of the inlet tube with the nut on the inside. Insert washers or gaskets on both sides of the hole.



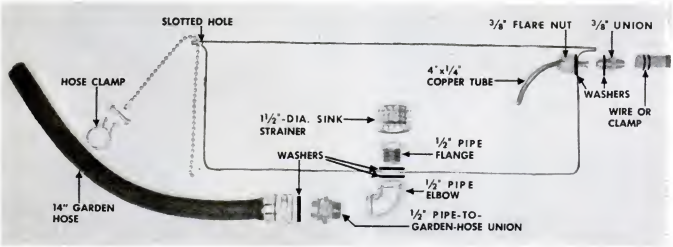
BROOMSTICK LEGS (or ¾" dowel) are about 7" tall, depending on size of your tank. Drill 1/16" holes through three, thread through copper or other non-rusting wires, and bind tight around the tank. Add protective crutch tips.

[*Continued from page 242*]

adapt an ordinary dishpan by shaping legs to match the sloping sides.

Water enters the tank through a 79-cent slip-on hose and drains out a short length of garden hose, so that you can carry the washer to any nearby sink without making permanent connections. One end of the inlet pipe needs to be flared to fit a compression fitting. You can have this done or do it yourself.

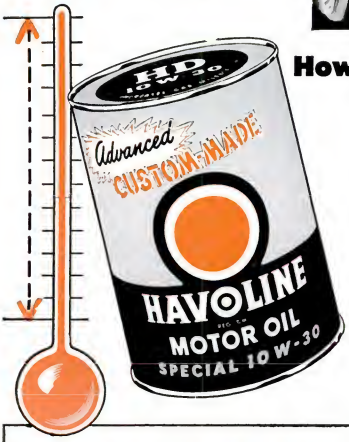
A small sink strainer placed over the drain opening keeps the prints from clogging the outlet and will stay put by its own weight. Once you've adjusted the faucet and outlet to the desired flow, you can leave your washer and forget it.—*Ron Anderson, Minneapolis.*



Texaco Tips On Car Care

How to enjoy → smoother starts

Oftentimes, a partially clogged carburetor is the cause of stalling and difficult starting. To prevent the impurities which jam up your carburetor, drain and clean the fuel pump sediment bowl. Doing this at regularly scheduled intervals will help you get smoother starts and freedom from stalling.



How to assure faster pickup, better gasoline mileage

Use the newest member of the Havoline Motor Oil family — Havoline Special 10W-30. Independent road tests proved this all-temperature motor oil best for your car. It's "light" for cold starts, has "body" to withstand heat. Test cars using Havoline Special 10W-30 accelerated faster, using less gasoline—and engines stayed clean. For more engine "zip," and longer engine life, change to Havoline Special 10W-30. See your Texaco Dealer, *the best friend your car has ever had.*

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TUNE IN: TEXACO STAR THEATER starring JIMMY DURANTE, on TV Saturday nights, NBC.

Milk Carton Starts Charcoal

MILK cartons packed with charcoal help you get outdoor fires off to a quick, easy—and clean—start. Punch vent holes, and set a match to tabs torn down one side. By the time the waxed cardboard burns out, the charcoal will be going nicely.—*Robert R. King, El Segundo, Calif.*

Sluice Carries Off Trapped Rain

A DOWNSPOUT that led to a corner between my house and the garage wing left some soggy puddles until I rerouted the water. I used a length of one-by-six for the base of this sluice and screwed on sides 2" high. Two coats of house paint have kept it attractive and in good shape for more than four years.—*Harry N. Webster, Nutley, N. J.*

Old English Gate Seesaws Open

PRESS the top stile of this old English gate and it knocks down the others. Then just climb up and over. The nesting hammer heads are carefully balanced counterweights to keep the bars horizontal, or diagonal for stepping over. The gate was used to keep livestock fenced in.—*David Scott, London.*

Nail Is Emergency Gas Shutoff

A LARGE nail can eliminate searching for a wrench if you have to turn the gas off at the meter in a hurry. Slip it through a hole drilled in the gas cock on the meter. The nail works like a spoke: turning it turns the cock. Be sure to blunt the point of the nail before inserting.—*Robert Burgett, Hamilton, Ohio.*

Candle Holder Is Vase, Too

A TEST TUBE fitted into the neck of a candlestick makes a handsome bud vase. Use velvet to wedge the tube into the socket. Decorate the tube with bands of colored adhesive tape, or paint it as desired. —*Walter E. Burton, Akron, Ohio.*

GET A MUFFLER CHECK TODAY

Mufflers can be dangerous without being noisy!

It's a *smart idea* to have your muffler checked periodically! Even tiny leaks can mean *carbon monoxide* in your car's interior. (It takes only a small amount of this deadly gas to cause drowsiness and possible accidents!)

Next time you stop for service, have your muffler checked. If you need a new muffler, *play safe*—get a *double-walled* MoPar muffler, designed especially for *your* Chrysler Corporation car or truck.

MoPar

PARTS DIVISION • CHRYSLER CORPORATION

[Continued from page 176]

wheeled in with siren wailing, leaped from his vehicle and began clearing a path through the spectators.

"Stand aside, folks," Corcoran roared, but when he saw Gus, he waved him on.

Running toward the smoke, Gus saw that it came from beneath the lifted hood of the Missouri Plymouth.

"Hello, Gus," Fire Chief Maloney greeted him. "You're just in time for a tow job—fire's about out."

HENRY MORTON was jumping about his beloved Plymouth with cries of anguish.

"Hah!" Morton exclaimed, seeing Gus, "I'll bet this is some of your doin'."

"I wouldn't say that," Gus told him mildly, probing beneath the hood with his flashlight. "Hmm, there isn't much damage here. I'll tow you back to the shop and fix you up in no time."

"Right handy for a tow job, ain't you?" Morton said suspiciously. "By cracky . . ."

"Henry!" Mrs. Morton cut in sharply. "I'm not going to stand here in the street all night while you argue. Mister, get your truck and tow us in."

As the fire truck wheeled away and the crowd dispersed, Gus hooked onto the Plymouth and towed it back to the Model Garage. When Stan Hicks saw Gus pull in with the Missouri car in tow, his eyes had a look of astonishment.

Gus got the Plymouth unhooked wordlessly and went to work with purpose. He removed the battery cable from battery post to starter button, finding that the terminal at the battery-post end had been melted off by the heat. He threw the cable on the floor, where newly melted solder gleamed, the insulation on the battery end burned off.

"When that stuff burns," Gus remarked, "it makes a sight of smoke."

Gus got a new battery cable from the stock room and installed it. He taped up a few wires that had been singed around the source of the fire, tested the battery and filled it with water. Then he got into the car and stepped on the starter button. The motor ran smoothly.

"Well," Gus said to Morton, getting out of the Plymouth and digging out his pipe, "I guess you folks are ready to roll again. That'll be six dollars. Three for the tow and three for a battery cable."

MORTON'S thin features lit with astonishment.

"You mean," he queried, "that after all that fire and smoke six dollars fixes everything?"

"Sure," Gus told him, his leathery features illuminated by the match he applied to his pipe. "Radio and all, unless I miss my guess."

"Radio and all," Mrs. Morton echoed. "Why, you didn't touch the radio."

"Right," Gus said. "You see, the way I had it figured, there never was anything wrong with your radio, seeing that you had a man check it and he said it was all right. When you told me the radio cut up only on rough roads, I had a hunch that you might have a hit-and-miss short somewhere in your car, which would make the radio squeal and squall as well as produce your occasional miss.

"It turned out your battery cable was shorting out on the edge of the battery box, but only now and then, on rough going. Finally, after you hit the rough stretch between here and the Twin Pines Inn, it happened to stay shorted when you stopped and went in to eat. That caused the fire. Lucky you didn't ruin your battery. I could have saved you three dollars by looking things over when you were in here the first time."

"Well, I'll be. . . " Morton began.

"Henry!" Mrs. Morton warned. "You talk too much. You'd do a lot better if you'd do more listening."

Morton shelled out six dollars and got into the Plymouth without saying another word. Looking after him as he drove out, radio playing full blast, Stan Hicks chuckled.

"There goes a man," he commented, "who has learned to like music." END

NEXT MONTH: Gus obeys orders.

All-chrome portable spotlight has powerful 4½" sealed beam unit. Perfect for night car repairs, spotting street signs, etc. Plugs into lighter socket. Pistol grip handle, with built-in on-off switch. 6 volts, 10-ft. cord included. (2L6116) **$5.59**

Wizard Flexible Radiator Hose. Made of tough neoprene rubber to resist damage from oil, grease, antifreeze. Steel coil spring construction. Full diameter. Ends tapered for easy installation. Fits all popular cars. (T8300-T8353) As low as..... **85c**

More pep and power! Marvel Mystery Oil lubricates top piston cylinder rings, hydraulic valve lifters of late model cars. Makes starting easier. For both crankcase, gasoline tank. Ideal year-around additive. 4 oz. (A1313) **30c,** Pt. (A1316) .... **85c,** Qt. (A1317) **$1.35**

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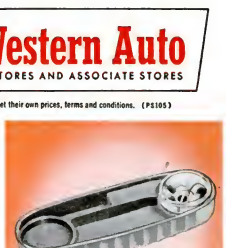
NOTE: In some areas of the U.S., Hawaii, Alaska, and Mexico, prices slightly higher. Western Auto Associate Dealers own their stores, set their own prices, terms and conditions. (PS105)

Guaranteed to fire in oil. Aldor Spark Plugs have bi-metallic thermostat control that keeps spark plug always at peak efficiency. Adjusts to any heat range requirement automatically. Special non-burning electrodes. In sets (LW12R-1) ....**95c** ea.

Guaranteed leakproof Wizard Muffler protects against deadly carbon monoxide gas fumes. Engineered to conform to original equipment specifications. Heavy, long-lasting steel construction. Gives your old engine "new car" silence! (T1148-1586).....From **$4.40**



Deluxe Magnetic Dash Tray. Big enough for sandwich, drink. Chrome ash tray lifts out. Hidden key compart. (C1379) **$1.69**
Magnetic Dash Tray. Colorful fade-proof plastic . . . adheres to any metal surface. Will not scratch. Asst'd. colors. (C1380) **64c**

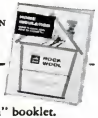
"TWINSULATE" THIS WEEKEND

SLASH HEAT BILLS up to 25% with new double-action INSULATION

Insulate your attic with new Gold Bond TWINSULATION®. Cut this winter's heat bills... and make your house up to 15° cooler next summer. TWINSULATION gives you a core of heat-blocking fireproof rock wool *plus* a heat-reflecting covering of silvery aluminum *all* around it. This double-action combination keeps winter furnace-heat in, and summer sun-heat out! If you have an average size attic you can TWINSULATE it in a few hours. Do it this weekend!

NATIONAL GYPSUM COMPANY • BUFFALO 2, N.Y.

Send for booklet. Shows you how much money Gold Bond TWINSULATION can save *you* in heat bills. Mail coupon now!



NATIONAL GYPSUM COMPANY
Dept. PS-105, Buffalo 2, N. Y.

I enclose 10¢ for "Home Insulation" booklet.

Name.....

Address.....

City.....*Zone*.....*County*.....*State*.....

Safety Features Show Up in '56 Cars
[Continued from page 101]

lem from a design viewpoint, 1956 models of Lincoln, Mercury and Ford cars are coming out with new safety features. Four of them are standard on all models:

• *Depressed-center steering wheel.* Its spokes are designed to absorb crash energy progressively, and the rim of the wheel gives a more distributed pressure area than the end of the column.

• *"Anti-fly-open" door latches.* The new design has a steel plate fastened to the locking rack on the door post. Its purpose is to keep the star wheel on the door from being jerked off the rack. Violent body deformation can still open a door, if either part of the latch is ripped out by the roots. But doors will *not* open under the comparatively slight body or chassis deformation that now pops them loose. The latch seems no more prone to crash jamming than current ones.

The fellow who drives with one hand on the wheel has one foot in the grave.
—THE SIDEWALK SUPERINTENDENT

• *Beefier seat attachment.* There's a heavier stop at the front of the adjustment rails, and sturdier fastening of the rear-seat back.

• *Safety mirror.* The rear-view mirror has rounded edges, and the mirror itself, while still plate glass, has an adhesive coating in the rear calculated to keep it from flying into lethal slivers.

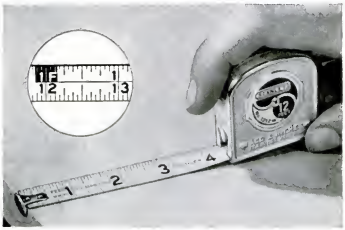
Optional, extra-cost features include the following:

• *Safety belts,* structurally anchored, that are made of heavy nylon and stressed for 4,000-pound loads. They use an ingenious buckle that will not jam locked after high loading. The price is about $14 a person, installed.

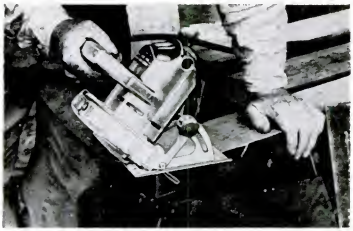
• *Crash padding* on top of the instrument panel, on top of the windshield frame, and on the sun visors, is a second option (price not yet announced). The padding, an energy-absorbing material, gives under impact but does not have dangerously rapid spring-back. END

STANLEY PUTS SKILL IN YOUR HANDS

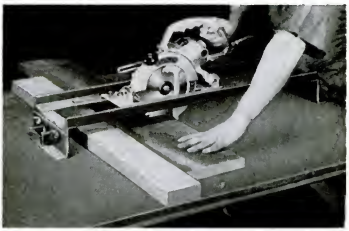
The "Yankee" Spiral Ratchet Screw Driver. This is a big, rugged, professional tool that takes the work out of screw driving. It drives and draws screws, and the spring-return handle is always ready *automatically* for the next stroke. Comes with three most wanted bits. **No. 130A — $8.20.**



144 inches of easy reading, easy-to-use, measuring accuracy in a compact 2 inch case. A full 12 ft. blade with *convenient* scales in both inches and feet and continuous inches, as shown. Rule comes in useful plastic box with magnifying lens. Be precise . . . say Stanley. It's a *good* rule. **No. 1212W—$1.89.**



The 7" Builders Saw. This heavy duty, portable electric saw cuts 2 x 4's at 45°. It's a work-hungry tool, loaded with power and designed to make tough jobs easy. Exclusive Stanley "Motor Saver" protects motor from impact loads, as when striking a nail, etc. Multi-grip handle . . . convenient switch . . . automatic safety guard. **No. H70 — $79.50.**



Saw Track for electric saw. This effective device is handy for many saw cuts where accuracy of angle is vital. It's virtually indispensable for production jobs like cutting rafters, fence pickets, etc. Recommended for cutting slate, marble, other stone with abrasive wheel on saw. **No. H158 — $19.95.**

STANLEY

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Gentlemen: Please send me
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- ☐ 25¢ Pocketbook — "How to Work With Tools and Wood" — I enclose 25¢.

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Address _____

City _____ Zone ____ State _____

Those Little Motors Everybody Uses
[Continued from page 160]

he heard of a miracle that might help: At Crown Point, N.Y., there was on display a three-pound magnet that was suspending a 150-pound anvil.

Davenport hitchhiked in a peddler's wagon to see the amazing magnet. But more miraculous even than the magnet was the idea that came to him:

"The red lightning of heaven," he said, "will soon be tamed and become the servant of mankind."

Davenport knew the "red lightning" was electricity because a crude wet battery was powering the magnet.

Out of intuition, out of scraps, and out of his wife's silk wedding dress (for insulation), he built several electric motors. The first ran at two revolutions per minute. Later he got up to 600.

He had a spinning magnet inside other magnets that formed a cylinder outside it—the principle of the electric motor.

With one of his motors (½-hp.) he drove a printing press—the first useful work ever performed by an fhp. With another, he ran a miniature electric railway—the forerunner of toy trains, and also of electric autos, street cars, interurbans, electric locomotives, subways, diesel-electrics, and trolley buses.

Davenport died, before he was 49, broke. But, a century and a quarter ago, he had got U.S. Patent No. 132 for an invention that (the patent read) "consists in applying magnetic and electromagnetic power as a moving principle for machinery . . ."

His neighbors laughed when he forecast all power needed for human purposes would be made available by this principle.

By 1965, GE market experts predicted recently, the modern U.S. home will use, not six, but 25 fhp's.

In 1955, nobody laughed. END

The Landlord

The neurotic—builds dream castles.
The psychotic—lives in them.
The psychiatrist—collects rent from both.—*Inventory.*

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why waste it!

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Be sure to insist on a fuel-saving, penny-pinching Rochester Carburetor for your own car . . . for any car you service!

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**Almost all wood grain is naturally crooked, irregular. Only Syncro exclusive "Multi-Motion" sanding pad action can sand with such grain and completely finish the whole surface. AND—built-in Syncro motors are guaranteed against burn-out all during your ownership!*

No. 900
HEAVY DUTY SANDER

Outlasts, outsands all other portables! No "jumping". So easy to use with *exclusive "Multi-Motion" action!*

Sanders

SANDING HANDBOOK, CATALOG FREE!

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AMERICA'S FINEST FINISH SANDER

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SYNCRO CORP.,
Dept. 2-75, OXFORD, MICH.

By SYNCRO
MULTI-MOTION SANDER

Ingenious Hoosiers Build Houses Indoors

[Continued from page 226]

day (48 man-hours later) they had completed all the wall panels and the roof trusses and were ready to deliver the package to the site.

On the building lot, where foundation and rough slab floor had been prepared, five men took four hours (20 man-hours) to set up the panels, plumb the walls, nail on plywood roof sheathing, and install windows and doors.

Lumber thefts plague conventional builders, but not the Mickles since they never need to leave unwatched lumber on the job. In five years they have missed only a paintbrush, and they are not sure that was stolen.

They build mostly on concrete slabs. Plumbing and radiant heating lines which run under the floor and a rough concrete floor are already in when the panels are delivered. A finished concrete floor is laid after the roof and interior partitions are in place.

Richard says that the panel method works just as well for houses built over basements. If he uses the conventional ceiling joist and roof-rafter system instead of trusses, he cuts rafters in the shop and eliminates sawing at the site.

"One major precaution is necessary when building in a factory," he says. "When we prefabricate, we have to be more accurate in our measurements. If we have a foundation that is square, level and accurate in all respects, we can put up the panels at fantastic speeds."

To prevent even slight deviations in measurements, the Mickles use only one 75-foot steel tape during the entire construction operation. The same tape used in laying out footings is used in marking saw cuts in a rafter.

"An individual prefabricator may be tempted to assemble panels too heavy for him to handle alone," Richard warns. "One man can handle a four-by-eight sheathed section. He can assemble much longer sections but may need help in moving them to a storage place.

"An eight-foot-high wall section of any

[Continued on page 256]

Now! The Lowest Price Ever for a Quality Electric Drill

New SKIL ¼" Drill

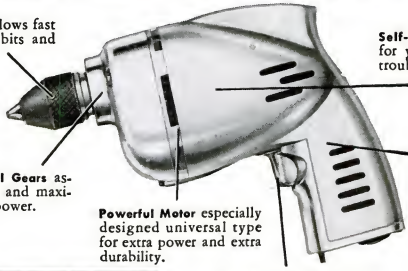
with Jacobs Keyless Chuck

***only* $19.95**

MODEL 535

No other drill on the market can match this combination of high quality, low price and famous name brand. Here is a SKIL Drill with *all* the features do-it-yourselfers want and need . . . priced for your budget workshop. Use it with accessories for literally hundreds of jobs at home, on the farm, on the job, or to add real pleasure to your own favorite workshop hobby.

Compare These Features with Higher Priced Drills:



Keyless Chuck allows fast change of drill bits and accessories.

Self-Lubricated Bearings for years of dependable, trouble-free performance.

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Pistol-Grip Handle gives greatest comfort and ease of handling.

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- **¼" Capacity in steel, ½" Capacity in wood**
- **2500 r.p.m. speed**
- **Only 3½ lbs.**

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Slow pickup when you step on the gas shows your power is fading . . . and it's

time to replace your Piston Rings!

Having to buy too much oil and gas, and slow pickup reveal POWER FADE! Your rings are badly worn—you're wasting money on lost power.

Top performance is gone. And despite the extra oil used, vital engine parts remain starved for oil. This is not only costly and wasteful, but is a warning of expensive repairs to come later.

See your motor specialist for a ring check-up. If he recommends a ring change, it will pay you to install Hastings *replacement* rings. They're engineered exclusively for worn engines to quickly stop power fade, oil-pumping and gasoline waste.

All the safety and driving enjoyment of full-powered performance are yours again with Hastings Rings . . . it's the best money you can spend on your car.

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Piston Rings, Casite, Oil Filters, Spark Plugs

* TOUGH but oh so gentle

HASTINGS
STEEL-VENT PISTON RINGS
Regular or Chrome-Faced

* TOUGH on oil-pumping * GENTLE on cylinder Walls

Ingenious Hoosiers Build Houses Indoors
[Continued from page 254]

length will go through a garage door, but a cellar prefabricator may have to use only four-by-eight panels which go through the normal door opening."

Experience unnecessary. Both Mickles testify that you don't need years of experience to build successfully. The senior Mickle, now 54, was sales manager for a steel firm in Chicago without previous building experience when he bought a plumbing and heating business in Attica, Ind. Soon he was in the middle of the postwar housing boom and began building.

In 1950 business became so good that he asked Richard, then 24, to become

An enterprising young husband is one who gives his wife an electric dishwasher so that both of them can get out of doing the dishes.
—THE SIDEWALK SUPERINTENDENT

his partner. Richard's only qualifications were courses in mechanical drawing and woodworking he had taken in Attica High School.

Three years ago John De Camp, sports announcer at Purdue University, asked the Mickles to build him a house in Lafayette. They sold five more before De Camp's was completed, and then set up shop permanently in Lafayette. Now they sell 95 percent of their houses to Purdue faculty members.

Besides preparing working drawings for the houses, Richard does rough and finish carpentry, concrete work, painting, and sets ceramic tile—all skills he has acquired within five years. The firm has a year-round crew of 12 men and hires other labor as jobs may require.

The Mickle system pays off against the toughest prefab competition in the country. Yet they sell their homes to quality-conscious buyers at a price (between about $10 and $12 per square foot of living space, plus land) that profitably enables them, in many instances, to undersell their huge competitors. END

don't be "sold" . . . get the facts

Make up your own mind

about the scroll saw that's best for you!

here are the facts about the

Rockwell-built DELTA 24" Scroll Saw

Professional woodworkers regard this saw as the finest—*at any price!* It's a precision machine that makes smooth, accurate cuts, yet has proved tough through years of punishing industrial operation. This precision, this ruggedness—*plus* the built-in safety and ease of operation—make it ideal for *your* workshop. *Compare these quality features:*

- Only scroll saw with variable-speed drive—the right speed to cut all materials.
- Built-in blade guard protects fingers.
- Cuts stock 2" thick, rips to center of 48" panel—converts to saber saw of unlimited capacity.
- Table tilts 45° front and right, 15° left.
- Universal lower chuck holds all types of blades, sanding, filing accessories.

Get All the Facts—then Compare

You must see this saw demonstrated—*try it yourself*—compare it with *any* scroll (or jig) saw made! Then MAKE UP YOUR *OWN* MIND! Your Delta Dealer is listed under "TOOLS" in the classified pages of your phone book. Or send the coupon for catalog.

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☐ Name of my nearest Delta Dealer.
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Another Product by **Rockwell**

DELTA QUALITY COSTS NO MORE

The story behind

FORD'S *exclusive new*

LIFEGUARD DESIGN

More than two years of intensive safety research and testing by Ford engineers in cooperation with universities, medical authorities and other safety experts have disclosed some interesting new data on accident injuries—and what can be done to reduce them.

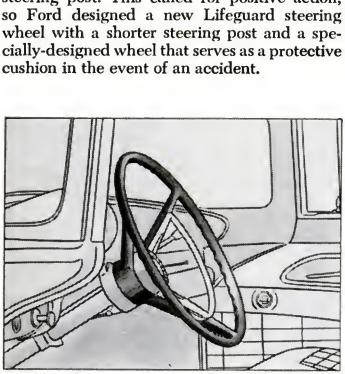
For example, it was found that most serious injuries in accidents were caused by *three* common occurrences.

First... the driver being thrown against the steering post. This called for positive action, so Ford designed a new Lifeguard steering wheel with a shorter steering post and a specially-designed wheel that serves as a protective cushion in the event of an accident.

Second... occupants being thrown forward against hard surfaces within the car. This called for special padding of the instrument panel and sun visors. So, Ford for '56 is offering optional Lifeguard padding for these vital areas.

Third... occupants being thrown out of the car. Ford approached this problem in two ways. There are new optional Lifeguard seat belts available to hold driver and passengers securely in their seats. And every '56 Ford has new Lifeguard door latches that feature *double-grip* construction to reduce the possibility of doors springing open under impact.

For the *full* Ford Lifeguard design story—visit your Ford Dealer—soon!



New Lifeguard Steering Wheel. Hub of wheel is more than three inches below plane of rim. Three uniformly spaced spokes are designed to yield under impact and reduce possibility of driver being thrown against the top of the steering column.

New Lifeguard Padding. The composition and uniform cellular-like structure of the new Lifeguard padding material results in an extraordinary ability to absorb shock. For example, tests show it is five times as shock absorbent as foam rubber.

Let Lifeguard design start protecting

You will be safer in a '56 Ford with Lifeguard design

New Lifeguard Seat Belts. They're one-third stronger than CAA requires for aircraft. Each belt is securely anchored to all-steel flooring which is reinforced by husky steel plates. Buckles permit easy one-hand adjustment and finger-tip release.

New Lifeguard Door Latches. Conventional single-grip latches may disengage (like fingers above at left) and allow doors to open under impact. Lifeguard double-grip latches (like fingers above at right) resist disengagement fore-and-aft, in-and-out.

you now in the '56 FORD

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Weldwood Contact Cement works like magic! No need for clamps or presses. Just apply... let dry... then bring laminate and surface together! Instantly you get a permanent bond!

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1001 JOBS MADE EASIER around home, shop, garage. Weldwood Contact Cement bonds any combination of wood, glass, leather, paper, cloth, fiberglas, metal (including do-it-yourself aluminum).

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New Lincoln: Bigger and Brisker
[*Continued from page 105*]

on the air cleaner and run a duct from it to a thermostatically controlled flap valve. Below 68-70 degrees the engine in part breathes gently warmed air from a little "stove" that is loosely fitted over the left-bank exhaust manifold. Above this temperature, it draws from a different duct that runs up ahead of the radiator, at the left side of the grille, where it takes in cooler outside air. An elbow at the end keeps out rain, bugs and the ram-air effect that upsets carburetor calibration. If the rig proves out as well as company engineers are convinced it will, it's a sure bet for imitation, both by Detroit and by the makers of kits for Saturday mechanics.

Prettier, too. In general styling, Lincoln seems better armed for the competitive wars than for some years. (The poor thing was caught with its windshield unwrapped in '55.) The family resemblance to the kid brothers is present but subdued; there is less of the hideous peril that a nearsighted neighbor might think you've bought a Merc. The past top line, the Capri, is now the plain, common or garden variety model; and a new one, the Premiere, is cock of the walk. Evidently nothing can be done at this point, at least, to keep this from being pronounced Pre-meer.

And the colors: Nothing like it since yesterday's sunset. **END**

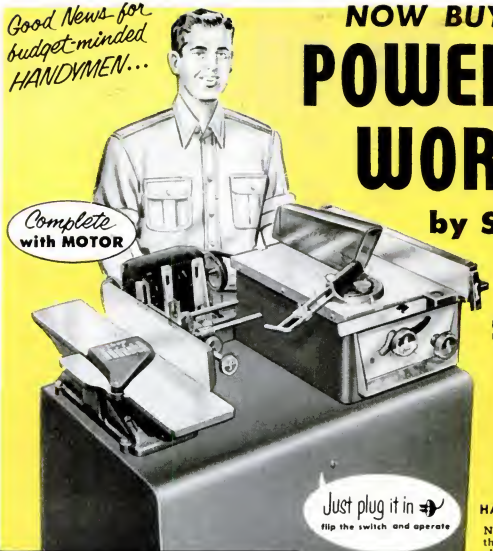
—*Public Safety* magazine

Good News for budget-minded HANDYMEN...

NOW BUY THIS BASIC

POWER TOOL WORKSHOP

by SHOPMASTER



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Plus Complete Line of Accessories

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Shopmaster Saw-Jointer Combination

- Ready to plug in and operate
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- Big husky 8" tilting arbor saw with 2½" depth capacity, 13"x16" table size, mitre gauge and rip fence
- Rugged 4" jointer-planer with ⅝" cut, 4"x26" table and flexible guard
- All steel stand is 26" deep, 34" long and 36" high
- Handy switch is conveniently located in front
- Both tools have sealed-for-life ball bearings
- Saw-jointer combination, stand and motor sell for only $174.50

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With the "Husky Boy" 200 amp. arc welder you can do profitable general shop and outside repair work; emergency service on pickup trucks—all on a low investment. It's compact and lightweight—easy to transport. For extra convenience when used inside, wheels and handles easily bolt to the unit, and are available at slight extra cost.

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☐ Check here for your vest pocket welding guide

How to Detect Heating Frauds

[Continued from page 115]

nately too hot and too cold. This is because adjustment of the controls permits air in the plenum chamber—the tank above the burner—to become too hot before the blower turns on. Thus, though the thermostat starts the burner on time, you don't feel its effect until you have begun shivering, and then you suddenly get a withering blast.

To correct this, heating engineers have worked out a procedure called CAC ("Continuous Air Circulation") that gives you warm air where you want it all the time. You simply readjust the furnace blower controls, leaving the thermostat at the room temperature you like.

Set the control that turns the blower on at 100 to 110 degrees (it's probably at 130 to 140 now), and the control that turns the blower off at 85 to 90 degrees (it may now be at 100 to 110).

Here's what will happen:

- The burner will turn on when the thermostat calls for more heat.
- The blower will cut in when air in the plenum reaches 100 to 110 degrees and begin circulating it through the registers in the house.
- The burner will shut off when the thermostat is satisfied.
- The blower will continue to operate until air in the plenum cools to 85 or 90 degrees, and in very cold weather, when the thermostat turns the burner on first, won't shut off at all.

The result is a more even temperature in the house at a slightly larger cost in electricity but a greater saving on fuel.

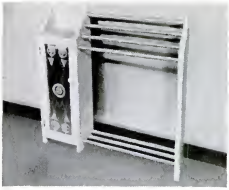
There is a third control at the furnace which prevents the burner from overheating the air in the plenum. Set it at 175 degrees.

CAC is applicable to most present warm-air oil-burner installations, but is not recommended by the manufacturers of small-pipe high-velocity systems.

Undersized furnaces. This is a common pitfall for buyers of new homes.

In a typical case, a man bought a development house because it had an attic

[Continued on page 264]



Bathroom Valet. Handiest addition your bathroom could have. Decorative storage cabinet door is made of hammered aluminum sheet. Requires wood, Do-It-Yourself Aluminum Tubing and sheet. Easi-Bild Pattern #29.

Serving Tray. Combines serving tray and stand in a useful and beautiful piece of furniture. Aluminum, Weldwood, Naugatap, Redwood and fasteners provide needed materials. Easi-Bild Pattern #52.

Weathervane. Pennsylvania Dutch design enhances the appearance of your house. Aluminum tubing, sheet, fasteners and wood are all you need. Easi-Bild Pattern #524.

Look for this rack containing Tubes • rods • bars • a wide variety of sheet designs • angles • fasteners • screen and storm sash sections • window hardware • Reynolon plastic film • trim strip.

Window Greenhouse. Have your own window conservatory—green things growing all year long. Can be made to fit any window. Requires glass, Do-It-Yourself Aluminum storm sash sections, angles and fasteners. Has three 14" glass shelves. Easi-Bild Pattern #566.

MAKE THESE 4 "AROUND-THE-HOUSE" IDEAS A REALITY

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Now is the ideal time to start any or all of these new do-it-yourself projects. Easy and quick to build whether you have a workshop or not. New Easi-Bild† patterns are simple to follow. Your nearby hardware or building supply dealer has Reynolds *Do-It-Yourself* Aluminum and dozens of suggestions for other uses.

REYNOLDS
DO-IT-YOURSELF*
ALUMINUM
is also available in Canada

*T. M. REYNOLDS METALS CO. †T. M. EASI-BILD PATTERN CO.

Reynolds Aluminum Service Corporation
2493 South Third Street, Louisville, Kentucky

Enclosed please find $.....for the following Easi-Bild patterns:

☐ No. 29 Bathroom Valet—35¢ ☐ No. 52 Serving Tray and Table—25¢
☐ No. 524 Weathervane—35¢ ☐ No. 566 Window Greenhouse—50¢

Name.....

Address.....

City.....Zone.....State.....

TIME SAVING TIPS

ALL YOU NEED IS A TUBE OF

DU PONT DUCO CEMENT

REG. U.S. PAT. OFF.

STRONG

To tighten loose screws, coat them with strong "Duco" Cement—holds fast even in plaster!

Train ivy on strings attached to house with tough, weatherproof "Duco" Cement.

CLEAR

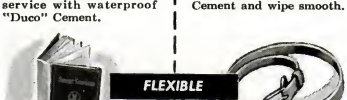
Emergency repair for flashlight lens—"Duco" Cement lets light through, seals rain out.

Put loose inlays back to stay—clear "Duco" Cement resets mother-of-pearl beautifully!

WATERPROOF

Put broken soap dishes, toothbrush racks back in service with waterproof "Duco" Cement.

To waterproof matches for camping, just dip in "Duco" Cement and wipe smooth.



FLEXIBLE

Restore cracked book bindings—tough, flexible "Duco" Cement takes a lot of hard use!

Fix belts. Rejoin layers of leather with strong, flexible "Duco" Cement.

NEW CAP
HAS HANDY APPLICATOR TIP

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

How to Detect Heating Frauds

[*Continued from page 262*]

where he could add rooms later and a basement that he could turn into a playroom. But the builder provided a furnace just big enough to heat the finished rooms. When the homeowner finished his attic and playroom, he had to buy a $500 furnace to heat the extra area.

A furnace to meet possible future demands may not cost much more than one sized for the present load. It's unwise, however, to buy an *oversized* furnace—it will cost more to run and do the job no better.

Lack of air for the furnace. If your furnace is in a tightly enclosed space, it may not get enough air for combustion and fuel will be wasted.

Here's how to check on whether your furnace gets enough air. Read the BTU input rating on your furnace. If the furnace is in a closet or enclosed space, the enclosure should have two openings at right angles to permit air to enter and circulate. The combined area of these openings should equal one square inch per thousand BTUs of input rating, but the opening should be at least three inches by three inches.

Faulty insulation. Supply risers in outside walls should be securely insulated on the three outside surfaces.

Many contractors "insulate" by pasting asbestos paper on ducts—a method, says G. A. Voorhees, technical secretary of the Warm Air Heating Association, which actually *increases* heat loss instead of decreasing it. He explains:

"The insulating value of asbestos is due primarily to millions of little dead air spaces. When asbestos paper is pasted on a pipe, many air spaces are filled with paste. Then the paper is put on while still wet. As it dries, it shrinks and squeezes out the remaining air spaces. The surface of the paper has been changed to a dull rough surface, which radiates more heat than the original smooth, bright surface of the duct.

"When insulating with asbestos paper, use the corrugated air-cell type, the kind

[*Continued on page 266*]

It's a Jig Saw!

It's a Router!

It's a Shaper!

ROUTO-JIG

Amazing new 3-in-1 tool!

Now! See and try the revolutionary *quality* tool that puts dozens of new skills at your fingertips – Porter-Cable's sensational new Routo-Jig! *Three most-wanted tools in one!*

Use Routo-Jig as a portable router, for mortising, grooving, rabbeting. Use it as a rotary jig saw—cut intricate contours and freehand shapes. Use it as a shaper, for accurate moulding, beading, joining.

Routo-Jig gives you truly *professional* results every time—in fine cabinet work, furniture-making, home improvements, shop work of every kind. And you can own it *complete* at a big $7.00 saving—if you act now!

Special introductory offer! Model 140 Routo-Jig, complete with Router Base, Jig Saw Base, and Shaper Table—

$61.95 value—now only $54.95!

SEE YOUR DEALER — OR MAIL COUPON TODAY!

PORTER-CABLE MACHINE CO.
5150 N. Salina St., Syracuse 8, N. Y.

Yes, send me a complete catalog sheet on the Model 140 Routo-Jig, and the name of my nearest dealer.

Name_____

Address_____

City_____ Zone____ State____

Porter-Cable

Quality Electric Tools

In Canada, write Porter Cable Power Tools Ltd., Box 5019, London, Ont. (Canadian prices slightly higher)

The engine is the heart of the bus's mechanical system . . . and bearings are guardians of the heart-beat!

Bearings carry heavy, dynamic engine loads . . . cushion the shock of fuel explosions. They meter the oil that lubricates the moving parts inside the engine. They work harder than ever before, yet today's bearings deliver from two to five times the mileage of the bearings of only 15 years ago!

Federal-Mogul bearings are preferred by the big truck and bus fleets, for bearing replacement, by 2 to 1. Replace with Federal-Mogul oil-control bearings to renew engine power and pick-up. *They are engineered for the job!*

for New Power . . .
FEDERAL-MOGUL
Oil-Control Bearings

RESEARCH • DESIGN • METALLURGY
PRECISION MANUFACTURING • SERVICE

How to Detect Heating Frauds
[Continued from page 264]

used in corrugated boxes. When it is wrapped around the pipe, dead-air spaces in the corrugations are retained. Fiber blankets are also good insulators."

Single-fuel chimneys. In the Midwest, natural gas is now the favored fuel. Many builders install metal flues which building codes permit with that fuel and *no other.* The Better Business Bureau warns home buyers that such flues force them to buy gas from a public utility even if the price goes sky high.

Wrong thermostat location. The thermostat is the brain of the heating system. If placed where it will be subjected to extreme heat or cold, it won't reflect true conditions of the house. The American Gas Association recommends placing the thermostat at least two feet away from any outside wall. Living or dining rooms usually are good locations.

A proper installation will give you heating comfort as good as it's possible to get. But it must be *proper!* END

Lights Up Like Christmas Tree

THIS German motorcyclist is happy in the knowledge that he is unusually safe. Electric blinkers are mounted on each shoulder. A rear-view mirror is fastened to his left arm. He and his equipment were on display at the recent German Inventors' Fair, held at Nuremberg.

It's easy, inexpensive to build this handsome space-saver

Against a paneled or painted wall, it combines a wealth of shelves, commodious cabinets and magazines on display. Easy to build of Western Pine woods, it can be the feature of a room.

The woods of the Western Pines* are a pleasure to work with. Clean-cutting, even-grained, smooth-surfaced, they come carefully selected and well-seasoned, take all finishes without grain-raising. See them at your lumber dealer's—ask him for an estimate.

FREE—"Installing and Coloring Your Walls of Western Pines." Also, "Friendly Home Ideas in Western Pine," new 86-photo booklet of building and remodeling ideas. Write for both to Western Pine Association, Dept. 414-L, Yeon Bldg., Portland 4, Oregon.

the Western Pines

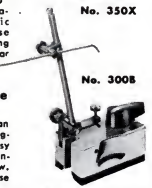
*IDAHO WHITE PINE
*PONDEROSA PINE
*SUGAR PINE

NEW LUFKIN MAGNETIC BASE TOOLS make your work easier

LUFKIN
MITI-MITE Magnetic Base FLUORESCENT LAMP with Magnifier

High intensity lighting coupled with 4-power magnifier. Two 5" lamps operate at body temperature, are protected by plastic chip shield. Adjustable goose neck with full swivel. Strong permanent magnets in base for quick positioning.

No. 350X



No. 300B

LUFKIN
MITI-MITE Magnetic Base SURFACE GAGE

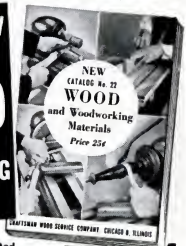
Is both a surface gage and an indicator holder. Permanent magnet can be turned off for easy positioning. Fully-adjustable spindle with fine adjustment screw. Scriber can be used below base when desired.

WRITE FOR FREE MITI-MITE BOOKLET

383 BUY LUFKIN TAPES • RULES • PRECISION TOOLS FROM YOUR TOOL DISTRIBUTOR

THE LUFKIN RULE COMPANY, Saginaw, Michigan

Get This NEW Catalog of WOOD AND WOODWORKING MATERIALS



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Your complete wood buying guide and project book. Craftsman is your best, most complete source of finest kiln-dried domestic and rare imported woods, beautiful wood inlays, colorful bandings, matched plywoods, embossed mouldings, carved ornaments, newest woodworking tools, "hard to find" cabinet hardware and fittings . . . more than 1,500 items! Packed with newest scroll saw patterns, project ideas & money making plans. Enclose 25¢ (refunded with first order) to help pay mailing, handling cost. Write now!

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128 PAGES
Many in full color
packed with rare, fancy & imported woods . . . veneers, plywoods, patterns, tools, ornaments, hardware . . . everything for the woodworker.
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Enclosed find 25¢. Rush me new *Woodworkers' Catalog Handbook.*

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CITY_____ZONE____STATE_____

"ARCO JIG-SAW"
WITH EXCLUSIVE NEW
CIRCLE-CUTTER & RIP GAGE!

- Another "ARCO" FIRST! "Arco Jig-Saw" (guaranteed to fit any ¼" drill) with Adjustable Circle-Cutter & Rip Gage saves hours of work—assures professional-looking results everytime—whether cutting circles, curved patterns, or straight cutting.
- Cuts perfect circles any size up to 20" diameter; rips accurate widths any size up to 10" wide.
- Has same capacity and cutting speed as $55 jig saws. Does work of Jig, Keyhole, Coping, Rip, Crosscut, Band & Hacksaw!
- Built-in "Air-Jet" blows away sawdust. Cuts intricate patterns—however large—in plywood, plastics, metals—even cuts 2x4's! Starts inside holes. Includes blade. Converts to Table Model with "ARCO STAND" Sturdy Casting $2.75
- 6 Extra Blades.....$1.95

RIPPING WITH GAGE

ONLY $8.95 No. 500 without Edges.
$9.95 No. 550 with Edges.

REVOLUTIONARY NEW
'ARCO-SAW'
with "DADO-ARBOR"
CUTS ANY GROOVE!
WHIZZES THRU 2x4's!

- Not even a $100 Portable Saw has a dado cutter! "Arco-Saw" (guaranteed to fit any ¼" electric drill) with sensational new "Dado-Arbor" adjusts easily to cut any size groove up to 1¾" wide x 1" deep in ONE CUT! Graduated Depth-Bevel-Rip Gages adjust for depth of cut up to 1¾", angle cuts to 45°. Amazing swivel action of "Dado-Arbor" (see sketch above) cuts large grooves cleanly and accurately with little power. "Dado-Arbor" is easily removed to use the saw for straight ripping, crosscutting or angle cuts. Right angle steel gear drive and safety-yoke permit ONE HAND operation. Includes quick-cutting 5" Safecut Blade.

CUT GROOVES LIKE THESE

ONLY $12.95

- BLADES—5" Rip, Crosscut or Combination.....$1.75
- SOLD AT BETTER HOME STORES EVERYWHERE. If not available, order direct and try these amazing tools on our UNCONDITIONAL 10-DAY MONEY BACK GUARANTEE. Send check or M.O. (ppd.) C.O.D.'s—plus post.

ARROW METAL PRODUCTS CO.
Dept. PS-10, 140 West Broadway, New York 13, N.Y.

Radar Island Rises 110 Miles at Sea

[*Continued from page 127*]

a steadier base than tossing picket ships, and, unlike radar patrol planes, they will function in all weather.

This was a job where textbook engineering had to be tossed out the window. The tower must offer minimum resistance to waves, yet be strong enough to stand up against the heaviest storm. The working platform must be high above the greatest hurricane wave, yet the base must be firmly rooted in the bottom. The unit must be compact, yet completely self-contained so its garrison can ride out gales that will cut them off from shore for a month.

Drillers showed how. Navy engineers, who planned the island for the Air

At no time does the end of a day come faster than when the fish are biting.
—THE SIDEWALK SUPERINTENDENT

Force, solved the design problem with a triangular platform mounted on three legs. Raymond-DeLong, the team of two contracting firms that is erecting the tower, solved the installation problem by drawing on experience gained in building platforms—Texas towers—for underwater oil-drilling in the Gulf of Mexico.

The platform was built watertight, like a ship, at the Bethlehem Shipbuilding Co., Quincy, Mass. It was towed to sea and its 15 supporting caissons were driven into the ocean bottom. DeLong pneumatic jacks raised it above water.

Manning a frontier. The island is scheduled to be completed next month and turned over to the Air Force. Following installation of the radar equipment, a force of 60 to 100 specialists will take over. As isolated as any frontier garrison, they will live on half an acre of steel deck, 110 miles from land. Only fogs, hurricanes, and winter and spring gales will vary the sea's monotony. That is, if the world remains at peace.

But if an enemy raid should come, Texas Tower 2 may provide the warning that can avert catastrophe. END

THE SURE WAY TO

KNOW

YOU ARE BUYING A FINE POWER DRILL

For top performance, choose the power drill equipped with a Supreme Chuck. The finest in quality and precision. Or replace your old style chuck with a Supreme. See your hardware dealer.

Supreme Chucks BRAND

SUPREME PRODUCTS, INC., 2222 S. CALUMET, CHICAGO 16

Only **HOLD-E-ZEE**
The Original AUTOMATIC-GRIP
SCREWDRIVERS

PROVIDE THESE FEATURES:

- **LOK-BLOK** that makes blade twist and impact proof.
- **GRIPPER** that snaps back—recedes deep into handle, giving full blade use.
- **HAND GROUND BITS**—chrome vanadium, chrome plated blades.

YET COST NO MORE THAN ORDINARY SCREWDRIVERS

At Leading Dealers Everywhere!

UPSON BROS., INC., ROCHESTER 14 N.Y.

A PRECISION LEVELING INSTRUMENT *for only* $12.95

With the New LEVELALL one man can do the work of two men and a transit, quickly, easily, accurately. All alone you can speedily level points for footings, forms, piping, batter boards, sills, lintels, floors, ceilings, roads, driveways, lawns — any type of construction work. Send for Free booklet or, better yet, order a DeLuxe Levelall today.

*Name*_____

*Street*_____

*City*_____ *Zone*____ *State*____

☐ Mail 75' DeLuxe Levelall @ $12.95 ☐ Regular 50' model @ $9.95 ☐ Ship postpaid full price enclosed
☐ Ship C.O.D. Money-back satisfaction guaranteed.

LEVELALL 81-J Webster Street, Rockland, Mass.

Wet basement? Protect it with

DURA-DRI

CEMENT COATING

Now it's *easy* to dry up and brighten a damp, dark basement—with DURA-DRI. You just apply this heavy bodied protective coating with a brush right over any porous masonry. Decorates in any one of four beautiful pastel colors. **DURA-STOP COMPOUND** fills holes and cracks through which water flows. Use this hydraulic cement when necessary before applying DURA-DRI. It sets in just three to five minutes!

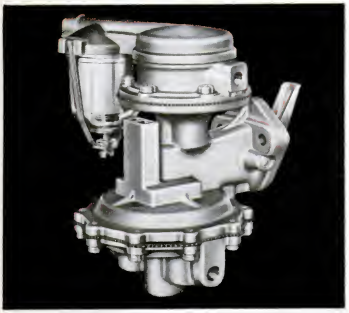
For further information on these two TEXOLITE* paint products, see your TEXOLITE paint dealer or write dept. PS-6 300 W. Adams St., Chicago 6.

U.S. UNITED STATES GYPSUM

UNITED STATES GYPSUM
the greatest name in building

*T. M. Reg. U. S. Pat. Off.

Two pumps in one!



...THE CARTER POWER CENTER® FUEL AND VACUUM PUMP

This versatile CARTER combination fuel pump provides continuous vacuum for your windshield wipers—at any speed or on acceleration.

You also have the high capacity of the CARTER fuel pump and the high-efficiency of the CARTER ceramic fuel filter . . . all built into one compact unit. It's easy and economical to install. See your CARTER dealer, or ask your serviceman.

CARTER CARBURETOR CORPORATION
St. Louis 7, Missouri
Division of ACF INDUSTRIES, INCORPORATED

[Continued from page 167]

is then pumped into a tube of iodine pentoxide connected to a second tube of potassium iodide and starch. Alcohol makes the chemical in the first tube release iodine fumes, which turn the solution in the second tube blue. A photocell measures how blue the second solution gets and indicates on a meter the percentage of blood alcohol.

The Intoximeter is a pocket-size device that gives a rough measure of drunkenness quickly. It was developed by Dr. Glenn Forrester, an industrial chemist of Niagara Falls, N. Y.

Like the Drunkometer, it has a balloon for the suspected driver to blow into. The cop then lets some of this air through a tube containing purple potassium permanganate and sulfuric acid. At the same time, he keeps an eye on the second hand of his watch. If the breath fades the purple color in 39 seconds or less, the driver is in trouble. The whole unit is then sent to a chemist, who analyzes other chemicals in another part of the Intoximeter for a precise measure of alcohol content. The unit, which costs $2.50, can be used for one test only.

The evidence supplied by any of these instruments is practically impossible to deny in court. Most authorities agree that anybody whose blood has a .15-percent concentration of alcohol—three teaspoonfuls in the whole bloodstream—is under the influence. Nobody carrying that much alcohol has normal possession of his mental faculties—he cannot drive safely. The law says so in 18 states. Seven ounces of 100-proof whiskey or seven bottles of beer within two hours will do it. END

Standard Equipment

SALESMAN: "This model has a top speed of 130 miles an hour and she'll stop on a dime."
PROSPECT: "What happens then?"
SALESMAN: "A little putty knife comes out and scrapes you off the windshield."—*Indiana General News.*

SHOP BY MAIL and SAVE at GROBAN'S

SURPLUS & NEW MANUFACTURE EQUIPMENT FOR HOME, FARM & FACTORY
ALL ITEMS UNCONDITIONALLY GUARANTEED!

PESCO GEAR TYPE

HYDRAULIC PUMP

Compact — Powerful — Reliable

ITEM #160—Especially designed for belt drive from fan belt, power take-off, drive pulley, electric motor or small gas engine. Equally suitable for direct coupling. Pedestal type mounting with two bolt holes for ⅜" hold-down bolts. Standard ½" pipe thread inlet and outlet ports. Delivers 4.5 GPM at 1000 PSI at 2800 RPM with 4 H.P. Hardened steel gears turn in dense oilite bronze bearings. Rotation—clockwise facing shaft. Guaranteed trouble-free service. Ship. wt. 6 lbs. F.O.B. Chicago **22.50**

SAVE $30.30 ON THIS PESCO

HYDRAULIC CONTROL VALVE

ITEM #371V

FOR SAFE POSITIVE CONTROL OF HYDRAULIC CYLINDERS AND MOTORS — ● BUILT-IN RELIEF VALVE—factory set at 1200 P.S.I. ● FOUR-WAY VALVE—to operate one double acting cylinder ● OPEN CENTER—with valve in neutral, cylinder is locked in position and pump is unloaded. ● SPRING RETURN TO NEUTRAL ● FULLY BALANCED SPOOLER ● EASILY STACKED INTO 2, 3, or 4 valve combinations for multiple cylinder operation. ● 8 gal. per min. capacity at 1500 P.S.I. ● ½" pipe ports ● CONNECT PUSH RODS TO HANDLE FOR REMOTE CONTROL. ● EASY MOUNTING. ● LIST PRICE—$46.80. YOU SAVE $30.30. ● DIMENSIONS: 9"x4½"x2½". Ship. Wt. —8 lbs. F.O.B. Chicago . **$16.50**

SELF-PRIMING

ROTARY PUMP

Item #104A—A fine reversible pump for gasoline, fuel oil, water, kerosene, etc. For fuel transfer, sump pumping, etc. Capacity, 400 gallons per hour. ¼" pipe thread inlet and outlet. Has built-in, adjustable relief valve, set at 30 P.S.I. Adjustable to 100 P. S. I. Rotation in either direction. ½" standard shaft, ball-bearing supported. Dimensions 5½"x11¼"x10". Shipping weight 8 lbs.

A $55.00 VALUE F.O.B. Chicago..... **16.50**

FACTORY-TO-YOU-VALUE

PORTABLE ELECTRIC LIGHT PLANTS

BRAND NEW 1955

ITEM #1008

POWER TO OPERATE:

- **Electric Saw, Electric Drills, Pipe Bender.**
- **Refrigerator, Deep Freezer, Incubator.**
- **Water Pump, Radio, Lights, Air-conditioner.**

COMPACT—FITS IN THE TRUNK OF YOUR CAR

1000 WATTS OUTPUT, continuous duty. 115 Volts A.C. 60 cycles, 9 amps. Powered by husky, easy starting Clinton engine. Engine and generator operate at 3600 R.P.M. for maximum efficiency at minimum weight. Both units are mounted on steel base, with heavy sheet metal belt guard. Generator is self regulating, and is equipped with outlet box containing fuse and 2 A.C. convenience receptacles. Cost only 5c an hour to operate. Dimensions: Length 20½", Width 12", Height 16". Shipping wt. 100 lbs. F.O.B. Chicago..... **149.50**

700 WATT—GENERATOR SET—same as above, slightly smaller—with Briggs-Stratton Engine—Model 708—F.O.B. Chicago..... **129.50**

U. S. NAVY ALL BRONZE CENTRIFUGAL PUMP

These all bronze Centrifugal Pumps are ideal for use as marine bilge pumps, circulating pumps, fire protection or irrigation, car-washing, dewatering, basement sump pumping, lawn sprinkling. Will pump water, oil, brine, gasoline, DDT and sulphur compounds. Equipped with 6" adjustable "V" pulley, 2" dia. inlet and outlet. 180 GPM capacity. Inlet and outlet take hose with 2½" inside diameter. Dimensions: 11"x8"x11".

Total head-feet	Speed	H.P.	GPM
25	3600 RPM	3	180
35	3000 RPM	1½	90
50	2400 RPM	½	75

Black plate may be routed for most convenient inlet position. Shipping wt. 31 lbs. Govt. cost $6,00. F.O.B. Chicago **29.50**

ITEM # 384

GROBAN

HYDRAULIC SPEED REDUCER

FILLER PLUG

CONTROL HANDLE ON OPEN SIDE OF BUTTON

OUTPUT SHAFT

INPUT SHAFT CONTROL SHAFT

ITEM #115

with **FINGERTIP CONTROL**

USE FOR: ● **Reamer Drives** ● **Midget Cars** ● **Feed Mills** ● **Canning Machines** ● **Conveyors** ● **Lathes** ● **Milling Machines** ● **Motor Boats** ● **Cream Separatrs** ● **Garden Tractors** ● **Pumps.**

Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of ¼ to 1½ H.P. Shaft—⅝" diam. Input rotation counter-clockwise facing shaft. Input speed 750 R.P.M. 7½" x 11½" x 7½". Gov't requisition cost $428.00. Ship. wt. 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago. **54.50**

300 AMP.

D. C. GENERATORS

IDEAL FOR WELDING GENERATOR

Type R-1, rated 300 Amps. 30 Volts. Mfd. by Jack & Heintz, Gov. requisition cost $381.00. Ship. wt. 55 lbs. Dimensions: 16"x10"x7". Complete with instructions to connect as Welder. F.O.B. Chicago **35.00**

ITEM #91

ITEM #92—When connected as a welder, this unit will deliver 200 amps for a sustained period and 250 amps for intermittent service. This Government requisition is widely used for shop-built portable welders. Rated 200 amps, 28 volts, 2300 R.P.M., using 10 H.P. Dimensions: 5" L. x 6" W. x 8¼" H. Splined drive shaft. Gov't. Acq. cost $300.00. Ship. Wt. 51 lbs. F.O.B. Chicago..... **22.50**

ITEM #99—For trucks, autos, marine equipment, construction machinery. 12 Volts—50 amps—4 bolt mounting flange—spline shaft —life time grease—sealed ball bearings. Mfrd. by Leece—Neville. Act. cost $163.00. F.O.B. Chicago. **Now only..... 16.50**

BELT DRIVEN

A. C. GENERATORS

ITEM #700

Ideal for powering electric tools, oil burner, refrigerator, lights, or other appliances requiring up to 700 watts of power. **700 WATTS,** 115 Volts, 60 cycles A.C. 3600 R.P.M. Compact, self-regulating generator with V Belt pulley and double outlet receptacle. Rotation counter-clockwise. May be driven by tractor or auxiliary gasoline engine. Requires 2 HP minimum. Dimensions: 10" long x 8" high x 6" wide. Shipping wt. 27 lbs. F.O.B. Chicago..... **59.50**

Model 1010, 1000 WATTS Same as above. F.O.B. Chicago..... **79.5**

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CUT ANY SIZE-ANY SHAPE → SPEARHEAD CUTTER

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★Accurately cuts circles from ¼" to 6" . . . odd shapes, straight pieces any size. ★Quickly, easily cuts gaskets, discs, washers, shims, patterns — from leather, rubber, asbestos, or any pliable sheet material. ★In use the world over — by some of the largest companies.

Long lasting blades of tempered steel. Durable cutting pad included.

COMPLETE:

Model A-14 Cutter, pivot pins, blades, cutting pad.

ONLY **14.50**

Postpaid

Send Check or Money Order . . . Satisfaction Guaranteed.

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CINCINNATI 12, OHIO

Send me the Spearhead Cutter, including blades, pivot pins, and cutting pad. My $14.50 is enclosed.

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CITY _____ STATE _____

I'm sending ☐ check - ☐ money order.

Kitty Kimsul says:

"Here's the easiest insulation of all to cut, measure and install!"

• KIMSUL Insulation is designed to cut winter fuel bills up to 33%—to keep your house up to 20° cooler in summer.

• And KIMSUL is clean—free of irritating dust and slivers.

• So light and compact even a woman can carry a 200 ft. roll—or take home enough in the car to insulate an entire attic.

Special at your Kimsul dealer's—this denim cobbler's apron. Regular $2.50 value—only 89¢

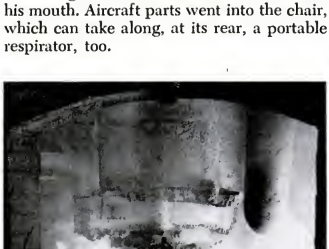
Perfect for hobby work, gardening, barbecuing. Has three large pockets, adjustable waist and neck bands. Only at your KIMSUL dealer's and only for a limited time.

KIMSUL INSULATION — A PRODUCT OF Kimberly-Clark

Kimberly-Clark Corporation • Neenah, Wisconsin

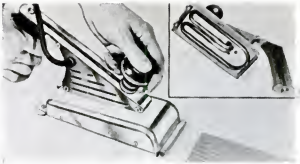
Mouth Muscles Run Wheel Chair

A STICK held in the mouth jiggers the controls that operate this motorized wheel chair invented by Ed Tilden Atkins of Chicago. A paralytic can go anywhere he wants to so long as he can still use the muscles of his mouth. Aircraft parts went into the chair, which can take along, at its rear, a portable respirator, too.



Two-Way Arc Melts Out Silicon

PINK quartzite melts at 3,100 degrees F. as a water-cooled electrode 2½ feet thick and 27 feet long fires an arc from top to bottom and then sweeps a rotary arc through the coked charge in this new silicon furnace. In an hour the Dow-Corning furnace at Midland, Mich., uses as much juice as most American homes use in three years.

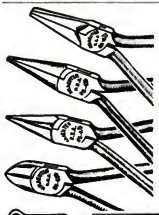


NEW ELECTRIC PAINT PEELER

Gets to bare wood fast

New, faster SUPER-POWERMET peels old paint clean to base wood grain like cutting butter with hot knife. Super-hot tube softens paint electrically. Removes up to 12 layers fast as 3½ sq. ft. per minute. A heavy-duty, professional-type tool. Ends scraping, cutting, burning, sanding, chemicals. Just plug into any AC or DC outlet and allow to heat for 1 minute. Then put it to work on interior or exterior surfaces like woodwork, clapboards, floors, cupboards, doors, furniture, boats, and see it peel off paint like magic. Complete with 8 ft. U. L. approved heater cord. Send $11.98 for postpaid delivery. Or, $2.00 deposit, balance C. O. D. plus postage. MONEY BACK GUARANTEE:

MERIDIAN CO., 366 Madison Ave., Dept. PS, New York 17



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Take BELSAW Portable Sawmill right to the trees—turn out valuable lumber for home and farm — sell to local yards — make up to $50 a day custom sawing for neighbors. BELSAW lasts a lifetime. No crew needed. Power with tractor or auto engine. Beginners get excellent results. Send today for FREE BOOK.

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THE FAIRGATE RULE COMPANY
DEPT. P.S. COLD SPRING ON-HUDSON, N. Y.

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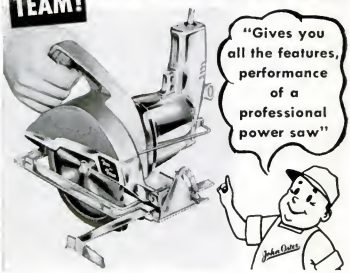
BIG VALUE TEAM!

NEW! Two BY Four Saw Attachment

works with Drill, Saw Table



CUTS FULL 2" DRESSED LUMBER

Amazing new TWO BY FOUR Attachment makes all sawing easy! Cuts 1-11/16" at 90°, 1-3/8" at 45°. Professional power saw features, too; Telescope Guard, Rip Fence Guide, Bevel and Depth Adjustments. Easy-grip handle for one-hand perfectly balanced use. Any Cummins 1/4" pistol grip geared chuck drill runs it. At your Cummins Dealer—Now!

ONLY $14.95

New Saw Table has *Para-Lock* Rip Fence!

TWO BY FOUR Attachment hooks to new Saw Table in seconds. Table has exclusive PARA-LOCK Rip Fence Guide —automatically aligns guide with blade. Table top 14-3/4" x 15-1/2". Easy to add wood extension for 24" x 24" surface. Complete with 10" miter gauge **$12.95.**

MODEL 624

get a *Cummins* Drill for better job results

Cummins Drills run quieter, —smoother, longer. They're made better, with shock-proof gears, double-coil motors, dynamically balanced armatures—to give better job results. Cummins Model 304, shown, **$24.95** Others from **$19.95** to **$34.95**

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Please send full-color booklet showing 64 ways to use power tools, and where to buy them.

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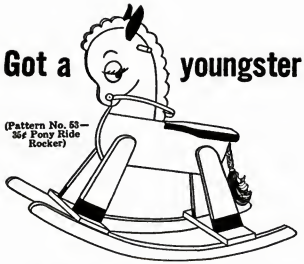

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Just trace simplified pattern on wood, saw and assemble. Big decorating guide insures a professional-looking paint job.

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NON-INFLAMMABLE

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PAINT REMOVER

The Klean-Strip Co., Inc.
2340 S. Lauderdale, Memphis 6, Tenn.

[*Continued from page 121*]

tination switching center. There another robot latches onto the line of the phone being called and, if it is not in use, rings the bell. All this happens faster than a girl can say "Operator."

The robot "memory" speeds up the call when it relays the number by translating the stored-up dial impulses into "musical beeps." Each beep tone represents a different digit in the called number. In beeps the seven digits flash across the continent faster than a human operator could finger even the first digit. In a matter of seconds, the phone is ringing at the other end of the line, and part of the robot has already disconnected itself from that particular call to go to work on another. But it can't cut loose completely. It must arrange for the bookkeeping: how to charge for the call. The same brain that memorized the two connected numbers hooks in another robot known as AMA (Automatic Message Accounting), which does what the operator used to do when she made out a tab for your call.

The AMA equipment records the two numbers, the calling time, the talking time, with thousands of holes punched into long rolls of tape. Once a day the rolls are run through sorting machines, and the record of each call comes out on a card. Fed into accounting machines, the facts on these cards emerge on your monthly phone bill.

A lot of protests over charges reported by AMA brains might have been expected. There was only one protest on a 5,000-bill check-up.

What about "wrong numbers"? If a 5-1-5 prefix were dialed, when 4-1-5 was intended, the robot would deliver Des Moines instead of San Francisco. Though the errors are not any telephone company's fault, management does not want them charged to the customers. So they are asked to report "wrong numbers" to the local operator who makes out a credit slip.

H.I. Romnes, chief engineer of AT&T,

[*Continued on page 286*]

NEW FOR THE HOBBYIST AND CRAFTSMAN!! DREMEL 15" Moto-Jig Saw gives you

more capacity! cutting speed! safety features!

. . . and more family fun than any other jig saw anywhere near its price!

Here's jig saw performance to make your eyes pop! The new HEAVY DUTY Model 15 Moto-Jig Saw is a real workhorse—rips through 1¾" wood—even a 2 x 4. Powered by a built-in ROTARY MOTOR (not a vibrator) it outperforms the clumsy and expensive cast iron type jig or band saw of the past. Now you can repair things around the house—build toys for the children—make beautiful new furniture, window valances, cupboards, etc. It's the first really safe jig saw—a foolproof blade guard eliminates all chance of finger injury. Weighs only 12 lbs. You can set up shop anywhere—actually convert a card table into a workshop! Deep 15" throat permits cutting to center of 30" circle. New ROCKER ACTION principle obsoletes all others. Until you've tried the new DREMEL you'll never know the money saving fun and excitement of a really modern power tool. Try it—bring it home—introduce your whole family to the new thrill in hobby and workshop tools. **SEE YOUR DEALER.** If he cannot supply, order direct on 5-day trial, money back guarantee. Or send $2, pay postman balance plus C. O. D. fee.

DREMEL MFG. CO., Dept. 125-K, Racine, Wis.

ELECTRIC DREMEL POWER TOOLS

beautifully styled in attractive brown and beige!

Sensational Model 8 Moto-Jig Saw

$29.95

Already a favorite with thousands of hobbyists and craftsmen. Same features, cutting speed and power as the new Model 15—with smaller 12" throat capacity. Cuts 1¾" wood—weighs only 9½ lbs. Compact, portable and quiet running. No TV or radio interference. A record breaking value: $23.50.

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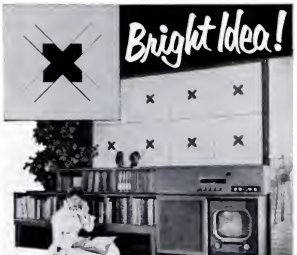

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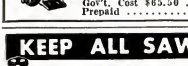

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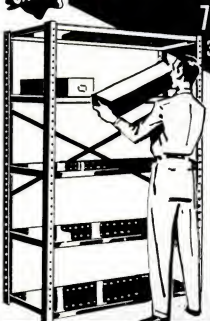

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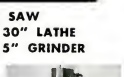
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200-250 Amp. 24 Volt DC. 4500 RPM. Makes dandy Arc Welder. Cost $396. Like NEW, SPECIAL $11.85 FOB Texas, $12.88 FOB York. Diagram Free. GOVT. Overhauled $19.95. GUARANTEED.

180° OFFSET DRIVE
(Reduction Gear)

86 to 1. For use where tremendous power at low take-off RPM is desired. 6 gears rotate on self lubricated Hi-Speed Ball Bearings. ¾" x 1½" shafts. 5" x 6" x 6" overall. $12.87 Postpaid. NEW Cat.-1000's Big Bargains —10c

KARL ORT, Dept. P.S. 10, York, Pa.

CONCRETE MIXERS
DIRECT FROM MANUFACTURER

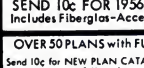
BEST SMALL MIXER MADE.
OVER THREE THOUSAND SOLD LAST YEAR.
QUICK DELIVERY. WRITE TODAY FOR CIRCULARS AND LOWEST PRICES.

UNITED STATES FORGE AND FOUNDRY CO.
CONSTRUCTION EQUIPMENT DIV. PULASKI, NEW YORK

NEW '56 CATALOG NEW '56 MODELS

BOAT KITS

BUY DIRECT-SAVE UP TO 2/3 I FACTORY-TO-YOU! No Dealers



You SAVE the PROFIT

Save on the finest quality boat kits. Lowest prices in history. Mahogany decks, brass screws, easy to build. 23 models 8-19' All types!

SEND 10c FOR 1956 KIT CATALOG!
Includes Fiberglas-Accessories-Trailers, etc.

BOAT PLANS

OVER 50 PLANS with FULL-SIZE PATTERNS

Send 10c for NEW PLAN CATALOG. Build your boat from modern, easy-to-follow plans with patterns. Saves time and money! All types included: Proms to Cruisers from 6 to 25'.

CRAIG-CRAFT (DEPT.30) TONAWANDA, N.Y.

This One
KQZD-XHG-Q5DF

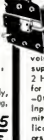
SAVE on PALLEY SPECIAL VALUES

PRESSURE TANKS

G1 Type Stainless Steel. Shatterproof and rustless. Has reinforcing ribs and its pressure tested up to 400 PSI. Has a high safety factor. Both ends have 1/4" pipe ports. It's ideal for use as a buoy, for drinking water supply, air supply for underwater fishing, diving, painting, spraying, cooking, etc.

G1 – 12½"×24" Stainless Steel	10.95
Corrosion Resistant Steel Tanks D-2 Tank. 500 cu. in. capacity	3.95
A-4 Tank. 104 cu. in. capacity	1.95

NEW VICKERS HYDRAULIC TRANSMISSION



Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies piston hydraulic motor. Has 2 H.P. Automatic pressure dash pot for smooth control. Power output RPM –0 to 1730 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Ideal for Lathes, Duplicator setup on Mills, Conveyors, Small Cars, Drives, etc.

44.50

4" SPLINE SHAFTS for input and power take-off on above. Pair $2.50

INPUT & TAKE-OFF PLATE ASSEM. To adapt Trans. to pulley drive. Has 1/2" keyway shaft. High speed bearings.

20.00 SET

NYLON ROPE

Finest Quality. Lustrous White. Has tremendous tensile strength.

SIZE	Strength	PRICE
1/4" Orlon	1100 lbs.	8¢ run. ft.
3/8" Nylon	2700 lbs.	13¢ run. ft.
1/2" Nylon	5000 lbs.	27¢ run. ft.
1" Nylon	18,000 lbs.	50¢ run. ft.

¼" sea green, braided Nylon, 1000 lbs. breaking strength. . . . 4¢ run. ft.

180° OFFSET DRIVE

NEW

For use where tremendous power at low take-off RPM is desired. 6 gears rotate on self-lubricating, hi-speed roller bearings. 85 to 1 gear ratio. Shafts are 1¼" & 3/8" dia. All NEW!

12.95 NEW

SOUND POWER PHONES

Used by Navy for Gun Control. An ideal emergency communication system because each set is 'sound' powered – no other power needed. Will reach any point-to-point in a radius of 1/2 mile. Each set includes 2 phones on chest plate, 2 headsets, button switches and wires approx. 35 ft. of wire. PER SET **9.95**

JACK & HEINTZ 2-SPEED ENERGIZER

Used on auxiliary power source to actuate aircraft starters. Has 2-speed control for 200 RPM low or 275 RPM high. Heavy duty gear box gives extremely high torque. Power 110-115V AC. Easy to convert to many power uses.

27.50

VICKERS VARIABLE DISPLACEMENT HYDRAULIC PUMP

Just Received in stock! Model AA20328. Has a built-in relief valve set at 2225 PSI. Continuous operating pressure is 1850–2000 PSI. The displacement is .600 cu. in. per rev. Swivel type inlet and outlet ports are 7/8" male tube. Cost Government approx. $1500 each.

$110.00 VALUE NOW ONLY **32.50** WITHOUT MOUNT

SAVE 50% on NEW PALLEY HYDRAULIC CYLINDERS

Announcing our own line of HYDRAULIC CYLINDERS. Designed to meet the most rigid requirements. ALL STEEL with "O" rings. Two types – 1500 and 3000 PSI. Full stock of replacement parts. We also custom build in any size to your specs. Write for special Hydraulics catalog of our complete line of New and Surplus Cylinders or see examples of New Cylinders below . . . .

BORE	STROKE	SHAFT	PSI	PRICE
3"	4"	1-1/8"	1500	$ 34.25
4"	5"	1-1/8"	1500	$ 39.50
4"	5"	1-1/2"	3000	$ 55.25
5"	18"	2"	3000	$ 97.50
5"	30"	2"	3000	$135.00

4 WAY-OPEN CENTER HYD. CONTROL VALVE

Has a built-in adjustable relief valve, set at 1000 PSI. Spring loaded neutral position. For use with one double action cylinder as above. May be mounted in series. Has 3/4" pipe inlet and outlet. 1/2" pipe thread cylinder ports. Shipping weight 10-1/2 pounds.

21.50

Excellent for Machine Shop, Garage, Truck, Boat, etc. Has 2500 lb. lift capacity through a 24 to 1 gear ratio. Bronze worm gear drive. 18 ft. of high tensile strength 3/16" steel cable. NEW!

HOIST MOUNTING FRAME

Specially designed for mounting the above winch. Frame only **4.50**

PORTABLE WINCH HOIST

LIFTS 1500 POUNDS – Made originally as a Bomb Hoist. Has 21 to 1 gear ratio. A 40" tubular arm extension with a 3" pulley. Drum has 12 ft. of 3/16" steel cable. Operating handle has ratchet brake. For "swing about" loading. $125 VAL. **27.50**

SAVE UP TO 50% BUY FROM IMPORTER

Genuine Select PHILLIPINE MAHOGANY LUAN PLYWOOD

Ideal For Fine CABINET WORK, FURNITURE, Paneling DENS, OFFICES, HOTELS, etc.

Our prices are LESS THAN DOMESTIC PLYWOOD at WHOLESALE. This selected LUAN MAHOGANY meets the most rigid specifications. It is WEATHER and WATER RESISTANT. You'll be amazed at the beauty of this fine wood. Its rich golden elegance will thrill you. Rotary cut for beauty of grain. Both sides sanded and ready to use. Bended with finest resin adhesive. Face side unjointed.

Available in three thicknesses – 3mm (approx. 1/8"), 4mm (approx. 3/16") and 1/4". All orders shipped by Special Truck for lowest rates. No order accepted for less than 100 lbs. – equal to (8) 3mm sheets, (6) 4mm sheets or (4) 1/4" sheets. . . . . .

See for YOURSELF FREE SAMPLE on request!

3 mm (1/8") × 3 ft. × 6 ft.	4mm × 4 ft. × 8 ft.	1/4" × 4 ft. × 8 ft.
$55.00 VALUE	$7.50 VALUE	$9.50 VALUE
1.79 PER SHEET	3.89 PER SHEET	4.99 PER SHEET
Minimum order 8 sheets	Min. order 6 sheets	Min. order 4 sheets

TRANSLUCENT FIBERGLASS PANELS

FOR A TITO STYLE

Special Purchase of 500,000 sq. feet. Save 40%. Finest Quality. In ALL lengths and widths. Full range of colors. As described in Oct., 54 issue of Popular Mechanics. Write for Free Booklet & Sample. 85¢ sq. ft. value . . . **49¢ SQ. FT.**

3400 RPM ½ HP POWER SAW

NEW

compares to saws selling up to 49.50

Ideal for HOME or SHOP

19.98 Complete with 5¼" Blade

RIPS – CROSSCUTS

CUTS A FINISHED 2×8 LIKE A KNIFE THROUGH HOT BUTTER!

A rugged, professional type, adjustable saw. Cut any angle, 0 to 45°. Has adjustable (0 to 6") rip fence. Safety-trigger switch on handle. Full ½ HP Universal AC-DC, 110-120 Volt, 60 cycle motor. Weighs 6½ lbs.

EXTRA SAW BLADES – Available in Rip, Crosscut or Combination. Please specify . . . . price per each **2.95**

SPORTSMAN'S 12 Pc. IMPORTED COMBINATION KNIFE

Eliminates 12 Individual Items from your Pack or Tool Kit!

(A $29.95 VALUE) **4.95**

COMPLETE CAMP KIT

Complete with Genuine Leather Holster!

NEW

4½" LONG RING HANDLE

Here is the Perfect, Combination Knife-Tool for every Outdoor Sportsman, Hunter, Camper, Fisherman, Boy Scout, Ranger, Rancher, etc. Think of it! 11, Fine quality Steel Tools, precision made to fold easily into the heavy bone covered body in one neat, compact unit you have (1) a regular knife, (2) a lock, (3) a spoon, (4) a draw knife (5) a bone saw and fish scaler, (6) a screw, (7) a can and bottle opener, (8) a cork-screw, (9) awl punch, (10) a screwdriver and (11) a metal file. All this PLUS a genuine leather, belt holster.

ORDER NOW While We Can Guarantee Delivery at this Special Low Price

ORDER FROM THIS AD – Pay by Money Order or Check. Purchase Orders accepted from D&B firms. 50% dep. with C.O.D.s. Prices F.O.B. our store!!

PALLEY SUPPLY CO 2263 E. VERNON AVE., DEPT. PS-10 LOS ANGELES 58, CALIF.

NOW! HOME CRAFTSMEN CAN OWN THIS PROFESSIONAL ARC WELDER

Trindl "100 TESTED" ARC WELDERS

FREE WRITE FOR COMPLETE DETAILS AND EASY PAY PLAN

Now you can own a Trindl full 125 amp Industrial Welder at a price far less than smaller machines. With a Trindl 125A you can weld metals up to ½ inch thick. Operates off either 110 or 220 volt line, properly wired. 16 heat stages from 20 to 125 amps. Make and repair anything of metal around the home, garage, farm or shop, like a professional. No previous experience or training needed. Full "do-it-yourself" instructions with each machine. Complete only $98.50 f.o.b. factory, or write for details. Trindl manufactures a complete line of heavy duty welding machines. Dealer inquiries invited.

EASY TERMS ONLY $98.50 F. O. B.

TRINDL PRODUCTS Ltd., Dept. T3-K
1807 So. Clark St., Chicago 16, Ill.

[Continued from page 274]

predicts that when the nationwide DDD installations are completed, about 80 percent of all long-distance calls will be direct-dialed. (DDD calls cost 40 percent less than person-to-person calls.) About 20 percent of all long-distance calls will always require operator service because they are person-to-person or collect. But even these are dialed by operators who are already dialing between most cities.

"What happens," I asked, "if I don't know the number of the person I want to call in San Francisco?"

"You call information who connects you with San Francisco information who gives you the number," explained Romnes. "It is faster and cheaper that way than stacking up directories in every exchange."

Dotting the country with these expensive mechanical brains is a segment of one of the greatest single investments in modernization ever undertaken by any collaborating group of companies anywhere. The Bell System now operates 42 million miles of long-distance circuits, some of them coaxial cables laid underground all the way across the country. Sheathed in a single lead covering about three inches in diameter, a coaxial cable will handle thousands of telephone conversations simultaneously, plus two or more television programs and several teletype circuits.

But much of our transcontinental talk goes over a remarkable system of radio relays on lofty towers, erected at about 30-mile intervals from New York to San Francisco. These towers are so spaced that the curvature of the earth and the humps of the mountain ranges do not obstruct their "vision." Each tower supports an eastbound and a westbound relay having sufficient frequencies to make 3,600 simultaneous conversations possible.

It is the lightning job of the robot brains in the exchanges to select one of these radio-relay or coaxial-cable channels and to hold it until you have dialed your number, gotten your party and finished your talk. After trying several routes, if no channel is available, the robot reports back to the home office and gives a busy signal.

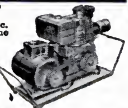
No nation does nearly so much long-distance telephoning as the United States. With six percent of the world's population, Americans have almost 60 percent of the world's telephones and last year made more than two billion long-distance calls! Even that figure will seem modest, AT&T officials predict, after DDD has put the rest of the country's telephones within seconds of your fingertips via that handy gadget, your phone dial. END

NEXT MONTH . . . How to Build Good Furniture

Do you go for modern stuff? Or are you an addict of classic lines? One of America's leading young furniture designers—Martin Stan Buchner—has designed especially for PSM home craftsmen a suite of dining-room furniture you'll be proud to make and use. It combines the best of contemporary design with the simple, clean lines and utility of Early American pieces. The series starts in the November issue of POPULAR SCIENCE MONTHLY with a *good* dining chair.

PORTABLE LIGHT PLANTS

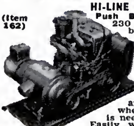
GIANT 2000-2500 WATT PLANT



110-120 v. 60 cyc. AC. absolutely the best made — exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted — portable. Powered by an easy starting Briggs or Wisconsin 6 HP engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty. (Item 31) Wt. 210 lb.
Reg. price $585. Special at..... **$299.50**
Same plant with electric self starter (Item 31a).......... **$359.50**
Generator only and control box....$169.50
DUAL VOLTAGE 110-220 available on any of above models for $28.00 additional.

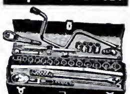
HI-LINE 6000 WATT PLANT

(Item 162)



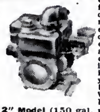
Push Button Start 115-230 v. 60 cyc. A.C. A brute of a power plant with a rugged 14.6 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth $995. With crank start.
Factory price **$585.50**
Same plant, but with self-starter, **$645.00**

52 pc. SOCKET SET



Highest quality, guaranteed non-breakable sockets made by Husky. Beautifully matched chrome thin wall alloy absolutely the best. Contains a complete set of 28 sockets in ½" drive, ⅜" drive and ¼" drive, plus all necessary extensions, handles, speeders, reversible ratchets, etc.; all uncond. guaranteed against breakage. A beautiful set of tools that will handle any job; in a big doghouse steel box. Wt. 17 lbs. (Item 205)
List price $62.90. Factory special.. **$27.95**

HI-FLO Centrifugal PUMP



Completely self-priming! No foot valve required. Tremendous capacity—100 gal. per min. ! . . Special impeller enables pump to handle muddy or sandy water. Simple to operate—simply start engine and watch the water go. Powered by a rugged, easy-starting 2 HP Briggs engine. Prelubricated sealed bearings for years of heavy low-cost service. **Big 1½" Model.** Item 502. Wt. 70 lbs.
Factory price... **$134.50**
2" Model (150 gal. per min.) with 2½ HP engine. Item 502a. 90 lbs. Fact. Spec. **$154.50**

Variable Speed Selector

(Item 68)

Heavy duty, made by **B. F. GOODRICH** for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists—any operation requiring variable speed. Employs reliable "trouble free" planetary system. No hydraulic power losses. Infinite range, smooth operation, easy installation. 3 sizes: ½-1 hp. 36 lbs.; 1-2 hp. wt. 55 lbs.; 2-3 hp. wt. 105 lbs.; Reg. list $228, $252 and $352. Our prices . . . **$79.50, $89.50 and $114.50**

JET FLOW BLOWER

Tremendous air movement (1800 CFM) and quiet operation make this double inlet 10" turbine blower unbeatable for heating, cooling, drying and air conditioning. Ideal for attic or barn ventilation, converting gravity heating to forced air; spray booth exhausts, etc. Operates with any ¼, ⅓ or ½ HP motor. Oversized, long life bearings. Includes variable speed motor pulley and belt. Dimensions 19" hi x 18" x 16½". Outlet opening 13" x 11⅜". Wt. 45 lbs. Item 245. Reg. $54.50.
Factory Special................ **$27.50**
HEAVY DUTY ¼ HP motor for above **$16.95**
12" TURBINE BLOWER Similar to above, but larger with 2400 CFM capacity. Wt. 65 lbs. (Item 245a) Reg. $70.00. Factory Spec. **$34.50**

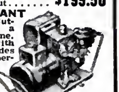
TERRIFIC SAVINGS at MASTER MECHANIC's
bedrock factory prices!

(Item 24)

600-700 WATTS
PUSH BUTTON START

115 v. 60 cyc. AC Powered by a rugged 2 HP easy starting Briggs engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24.) Wt. 75 lbs. Easily fits in car trunk. Be prepared if storm knocks out power lines. Reg. $275 value..... **$143.50**
1000-1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine with 50% greater output....... **$199.50**

1300-1500 WATT PLANT



115v. 60 cyc. AC Push Button Start. Powered by a 3½ HP. Clinton engine. Combines big output with easy portability. Provides emergency power for operating any oil burner, sump pump, freezer, television, lights, communications systems, etc. which require up to 1500 watts. (Item 22). Wt. 110 lbs.
Reg. $475 value, Factory price... **$239.50**
1750 Watt Plant Powered by 4.5 Briggs engine. Electric starting & battery charging built-in! Factory price... **$279.50**

MASTER-LITE 2500 Watt Plant

(Item 21)

110/120 v. 60 cyc. AC. A powerful plant, ruggedly constructed and yet designed for easy portability. Can be started by rope or built-in 12 v. electric push button starter. Built-in winding to charge battery. Powered by a big 5.10 HP Briggs engine, complete with all accessories. Includes control box, voltmeter, and handy plug-in power receptacle. An ideal plant for permanent or stand-by service. Wt. 225 lb. Reg. price $645.00
(Item 21) Factory Price **$329.50**
3500 Watt Plant Push Button Start (Item 23) 115 v. 60 cyc. AC. Similar to above, but larger and 33% more capacity. Wt. 270 lbs. Reg. $760. Factory Price............**$379.50**
Dual Voltage 110/220 available for above plants for $30.00 additional.

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range removes kitchen smoke and odors. Powerful, continuous duty motor, 110-120v. AC. Mount in wall or ceiling to ventilate any area. Quiet, super-efficient fan moves huge volume of air. (400 to 600 CFM).

8" Pipe, wt. 5 lb.	$6.85
9" Pipe, wt. 6 lh.	$7.85
10" Pipe, wt. 7 lb.	$8.85
12" Pipe, wt. 8 lb.	$9.85

HEAVY DUTY FAN. Semi-enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, etc. 10" Fan, wt. 8 lbs. (Item 10E)................$11.95
12" Fan, wt. 10 lbs. (Item 10D)....$12.95

CONDITIONAIRE VENTILATING FANS

Save big money installing your own exhaust fan. Efficient propellor type blade moves huge volume of air quietly and effortlessly. Heavy welded frame — pre-drilled for easy installation. Just cut opening and bolt in place. **Continuous** duty motors. Ideal for attics, restaurants, garages, barns, chicken houses, etc. Control manually or with thermostat.

Blade	Opening	CFM	Wt.	Item	
16"	18¼"	2925	19 lb.	365a	$27.95
18"	19¼"	3600	27 lb.	365b	$31.95
20"	21¼"	4100	30 lh.	365c	$39.95

EXTENSION CORD

Heavy duty and very flexible. Neoprene 14-2 cable, 20 year quality. Wt. 12 lbs. (Item 185) 100 ft. Complete with rubber plug and outlet. A terrific buy at only **$8.95**
No. 10-2 POWER CABLE. Heavy duty, very flexible, rubber covered, 50 ft. with male and female fittings. Wt. 9 lbs. (Item 592a) **$10.45**
50 ft. without fittings (Item 592)....**$9.45**
NO. 12-2 POWER CABLE. Very flexible rubber covered, special outside shield for grounding power tools, etc. 50 ft. (Item 199) wt. 8 lhs. **$6.95.** 100 ft. (Item 200)........**$12.95**

NEW PERMA-CLEAR
permanent bronze oil filter

Magnified section of new micron-size bronze ball element in the finest filter yet made!

CHANGE OIL ONLY ONCE A YEAR!

Never replace this filter, just give it a periodic rinse in gasoline. A permanent, non-clogging filter that protects oil longer, adds years to engine life, reduces friction and increases power. Revolutionary new filter element made of micron size bronze balls formed under tremendous heat and pressure into a far finer screen than can be woven from any metal or cloth. Super-porous, yet non-absorbent, it passes anti-sludging oil additives and detergents, but filters out the tiniest particles of hard carbon metal or water. Assures your engine of a perfect, clear film of oil for 20,000 miles. Only "Perma-Clear" is made with controlled porosity, insuring uniform filtering action. Only "Perma-Clear" can offer 47 different models, each one specifically designed for a certain engine. Unconditional 30 day money back guarantee. Shipped postpaid.
CONVERSION KIT—fits your present filter. (Specify filter make and model no.). **$9.85**
COMPLETE FILTER for engine not equipped with any filter.............. **$14.95**

9 TON HYDRAULIC PRESS

A tremendously powerful hydraulic press, capable of exerting 18,000 lbs. pressure. Pays for itself many times over—straightening bent connecting rods, king pins, crankshafts, axles, link pins and bars — or pushing out frozen bearings and bushings. Developed pressure under precise control and visible at all times on accurate gauge. Complete with both large and small anvils and jigs to straighten any kind of curve or bend. (Item 464) Wt. 110 lb. Actual list price $365. Our special close-out price.... **$69.50**

JET STEAM MASTER

Now, a super efficient portable steam generator that produces live steam at 100 lbs. pressure in 60 seconds from a cold start! Produces large volume of high pressure steam on 2 pints of fuel oil. Instantly cleans sticky grease, dirt, rust, old paint, etc. off implements and road machinery. Pays for itself in a few weeks. Sterilizes soil. Sterilizes as it cleans—milk equipment, etc. Fully automatic—oil fired with new, built-in lifetime bronze water circulating pump. Draws water from faucet or bucket. Simple and safe—anyone can use it; built-in safety valve. Complete with 12 ft. of hi-pressure steam hose and new triple efficiency steam gun that automatically mixes in soap solution if desired. Wt. 250 lbs. Item 463.
Special factory price........... **$329.50**

(Item 280)

MASTER DC ARC WELDERS

Now! a portable, rugged, industrial type welder with terrific performance, yet at a price hundreds of dollars less than you'd expect. Senior model made for years of trouble-free, continuous service. High capacity DC welding unit enables you to tackle any job with confidence—easily welds anything up to 2" plate using from 1/16" to ¼" rods. Built-in stabilizer and cooling system makes arc easy to strike and hold. Dual control rheostat provides low heat soldering, brazing and welding from 30 to 300 amps. Complete with instructions, guarantee and triple V-belt or flat pulley. You can pay more, but you can't buy a better welder.
WELDER ONLY — DUAL CONTROL MODEL. Same as above, but drive with your tractor, jeep or gas engine of 14 HP or more. (Item 38a.) Wt. 110 lbs. $450 value......... **$119.50**
WELDER ONLY—STANDARD MODEL. Same as above but with single rheostat for heavy metal welding only. (Item 38.)
Wt. 110 lbs. $400 value. Special.. **$99.75**
COMPLETE POWER MASTER (Illustrated above) powered by a 14.6 hp., air cooled Wisconsin engine. Wt. 480 lbs. (Item 280) Compares with welder costing $1200.
Factory Special.................. **$449.50**

Send check or M.O. Prices f.o.b. Factory. 10 day Money back guarantee. SEND 10c for . . . *BIG 1955 Catalog*
MASTER MECHANIC MFG. CO., DEPT. 27-L Burlington, Wis.

WELDING KIT Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at... **$10.50**

CENTERS AND DRILL PADS

STEEL AND BRASS COLLETS

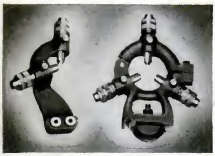
BALL BEARING LIVE CENTER

HANDWHEEL COLLET ATTACHMENT

YOU CAN DO MORE WITH SOUTH BEND LATHES

because of the very complete line of practical attachments available. Only a few are shown here. Send for complete catalog.

SAFETY and STANDARD LATHE DOGS



FOLLOWER AND STEADY RESTS

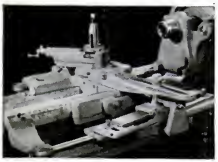
ADJUSTABLE COLLET BUSHING CHUCK

HANDLEVER BED TURRET

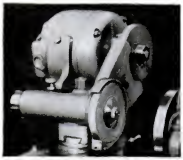
South Bend Attachments will enable you to do more and better lathe work. Write for our new Attachment Catalog.

SOUTH BEND LATHE

BUILDING BETTER TOOLS SINCE 1906 • SOUTH BEND 22, INDIANA



TELESCOPIC TAPER ATTACHMENT



EXTERNAL GRINDER

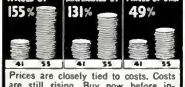
MILLING ATTACHMENT

10 in 1 TOOL BLOCK

Compared with our costs

OUR PRICES ARE LOWER

than they were back in 1941



Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

SEND INFORMATION CHECKED:

☐ 9" and 10" BENCH LATHES ☐ 10" to 16-24" FLOOR LATHES ☐ DRILL PRESSES ☐ TOOL GRINDERS ☐ ½" & 1" Collet TURRET LATHES ☐ 7" BENCH SHAPERS

Name_____ Company_____

Street_____ City & State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

I'll Train You AT HOME in Spa
Good Jobs in RADIO-TE

America's Fast-Growing Industry Offers You

1. EXTRA MONEY IN SPARE TIM

Keep your job while training at home. Many NRI students ma $10, $15 a week extra fixing neighbors' sets in spare time, start soon after enrolling. The day you enroll I start sending you spec booklets that show you how to fix sets. You use the Multitester bu with equipment I furnish to locate and correct set troubles. Ad Kramlik, Jr., Sumneytown, Pa., wrote: "Earned $12 to $15 week, spare time. Now have my own Radio-TV shop."

2. GOOD PAY JOB

Radio-Television growth a expansion and new uses known principles are making more jobs for well-trained m There are over 3000 Radio Broadcasting Stations on the air giv good pay to operators, technicians. Over 115 million home a auto Radios are now in use, providing full time and spare ti servicing opportunities. Government, Aviation, Police, Sh Micro-wave Relay, Two-way Radio Communications for bus taxis, trucks, railroads are growing fields of opportunity.

3. BRIGHT FUTURE

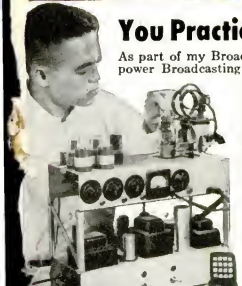
About 200 Television st tions are now on the air fr coast-to-coast. Hundreds more being built and hundreds of oth authorized. These new stations will need operators, technicia More than 25 million Television sets are already in use and requ servicing. Thousands more Television sets are being sold eve week and need installation, servicing. Act now to qualify for good job or your own sales and service business. Cash in on t rapid growth.

Television is Making Good Jobs, Prosperit

Training plus opportunity is the PERFECT COMBINATION for security, advancement. When times are good, the trained man makes BETTER PAY, gets PROMOTED. When jobs are scarce, the train man enjoys GREATER SECU ITY. NRI training can help ass you and your family more of t better things of life. My train is practical, complete; is backed 40 years of success training men home. My well illustrated less give you basic principles you ne and my skillfully developed kit parts "bring to life" things y learn from the lessons.

You Practice Broadcasting *with Parts I Send*

As part of my Broadcasting Course I send you kits of parts to build the low-power Broadcasting Transmitter shown at left. You use it to get practical experience putting a station "on the air," performing procedures demanded of broadcasting station operators. An FCC Commercial Operator's License can be your ticket to a better job and a bright future. My Communications Course gives you the training you need to get your license. Mail card and see in my book other valuable equipment you build.



You Practice Servicing *with Parts I Send*

Nothing takes the place of PRACTICAL EXPERIENCE. That's why NRI training is based on LEARNING BY DOING. You use parts I furnish to build many circuits common to Radio and Television. With my Servicing Course you build the modern Radio shown at right. You build a Multitester which you use to help fix sets while training. Many students make $10, $15 a week extra fixing sets in spare time, starting a few months after enrolling. All equipment I send is yours to keep. Mail postage-free card for Actual Lesson and Book.

Find Out What Radio Television Offer You

Without obligating you in any wa I'll send an Actual Lesson to pro that training at home is practic I'll send my 64-page book to sh good job opportunities for you Radio-Television, show equipm you build, show what my gradua are doing and earning. Terms NRI training are as low as $5 month. Many graduates ma more in two weeks than the to cost of my training. Mail coup now. J. E. SMITH, Preside National Radio Institute, De 5KB, Washington 9, D. C. O 40TH YEAR.

The Tested Wa to Better Pa

MONTAMOWER'S NEW MOBILE BLITZ-BURNER

TRADE MARK

AND NOW THIS . . .

IS GOING THE WAY OF THIS . . .

OBSOLETES UNSIGHTLY OLD-FASHIONED TRASH BURNERS

Special, Durable Armco Aluminized Steel . . . Attractive and Stays That Way . . . Need Not Scorch Lawn or Driveway . . . Roll It Where You Want It . . . Light It, Leave It!

It's New! It's Revolutionary! It's the first outdoor home appliance scientifically designed for the efficient collection, storage and disposal of burnable household, lawn and garden waste!

It's built to last and stay good-looking for many years. Entire electric-welded and reinforced body made of special rust and corrosion resistant Armco Aluminized Steel which will not distort. Combines the strength of steel with an inner and outer wall of aluminum. Highly efficient, completely enclosed unit with adjustable draft and exclusive smoke reducing combustion dome and mixing chamber. Quickly burns contents to a fine ash with no flying sparks. Ashes and partially burned debris cannot blow out to scatter around the yard and neighborhood. With a BLITZ-BURNER you don't have to "Stand Guard" 'til the flames die down . . . just light it and leave it! (No special starting fuel required.) Removable handle serves both as dome lifter and poker.

It's mounted on steel disc, rubber-tired wheels . . . rolls right up to kitchen door, leaf pile or garden . . . weighs only 26 lbs. . . . saves the work of carrying trash to the burner! Can be fired safely anywhere. Heavy, solid cold-rolled steel bottom . . . you need not scorch lawn or driveway!

It's a clean container for the accumulation of burnable waste . . . contents are protected from rain and snow . . . kept dry to burn readily! Compact design (20" x 36" overall); stores in minimum space. If you act at once you can get the $4.95 Barbecue accessory FREE OF CHARGE — Mail coupon below for complete details on Special Introductory Offer!

Park it anywhere for handy accumulation of contents . . . holds 3½ bushels.

Patent Applied For

Wheel it to the leaf pile — burn them on the spot — need not scorch lawn or driveway.

Barbecues steaks and hamburgers to perfection.

WONDERFUL BAR-B-Q WITH LOW COST ACCESSORY

Just invert combustion dome which seals off inside of burner and insert charcoal grill.

ONLY $4.95

BUILT TO LAST FOR YEARS—PRICED WITHIN THE REACH OF ALL!

FREE! REGULAR $4.95 BAR-B-Q With Every BLITZ-BURNER

MONTAMOWER DISTRIBUTING CO. (MANUFACTURER)

PS-10 KEELER BLDG., GRAND RAPIDS, MICH.

Gentlemen: Please rush details on FREE BAR-B-Q Introductory Offer on the new BLITZ-BURNER, full-color illustrated literature and FREE Barbecue Hat.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

MAIL COUPON TODAY